# A METHODOLOGY FOR IDENTIFYING LEARNING ACTIVITY SETTINGS AND USER NEEDS IN EDUCATIONAL FACILITIES

BY

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**In**

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## DEANSHIP OF GRADUATE STUDIES

This thesis written by **HASSAN ALI BALFAQIH** under the direction of his thesis advisor and approved by his thesis committee, has been presented to and accepted by Dean of Graduate Studies, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENC IN ARCHITECTURAL ENGINEERING**.

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**DEDICATION**

*Affectionately Dedicated*

*To*

*The Soul of my Mather,*

*To my Father,*

*Brothers, Sisters,*

*Wife and Children*

## ACKNOWLEDGMENT

*In the name of Allah, Most Gracious, Most Merciful*

All praise is due to Almighty Allah (SWT), whom we praise, seek help and ask forgiveness. Pace and blessings of Allah (SWT) be upon his slave and his messenger, Prophet Muhammad (PBUH), his family, and his companions. Many thanks to Allah (SWT), the most Merciful, the Most Gracious, for all the uncountable bounties, whom gave me the courage and patience to successfully accomplish this work.

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# THESIS ABSTRACT (ENGLISH)


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| **Name:** | **Hassan Ali Zain Balfaqih** |
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Schools are a distinctive type of facilities that house a large number of occupants for the purpose of learning, dissemination of knowledge, and developing skills for life. However, a main problem facing today's architects is failure to accommodate the requirements of the 21st century's education in the 19th century's architecture. In Saudi Arabia, currently there exists a strong emphasis on testing, accountability, curriculum reform and teacher quality. However, there is little hard data to inform the debate about which aspects of school and facility design enhance learning and education.

The objectives of this thesis are to identify the activity settings that are demanded by the evolving educational requirements, and to present the findings of a case study carried out to assess the capability of the public schools in Saudi Arabia in accommodating the identified activity settings. It also aims to develop series of design guidelines pertaining to the activity settings demanded in public school facilities. For the purpose of achieving these objectives, the research has identified various learning methods and their associated activities that are expected to last in the future and have the potentials to achieve the goals and objectives of education. Based on the identified learning methods, a conceptual structure for the physical environment of school composed of fifteen activity settings was proposed. A representative sample of public schools in Saudi Arabia was then assessed to investigate the extent of support for the proposed activity settings in the currently adapted school models. Based on the assessment results, and innovative school designs and research, a series of design guidelines were developed pertaining to each identified activity settings. The research presented in this thesis aims at to contribute to the efforts of translating the educational requirements into a responsive physical learning environment.



**MASTER OF SCIENCE DEGREE**

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# ملخص الرسالة


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**عنوان الرسالة:** **"منهجية لتعيين البيئة الفيزيقية للأنشطة التعليمية و احتياجات المستخدمين في المنشآت التعليمية"**

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تعد المباني المدرسية منشآت فريدة في غايتها إذ إنها عمارة معنية بصناعة العقول و إعداد الناشئة لمعترك الحياة. و على الرغم من هذا الوظيفة الفعَالة و الرائدة، مازال كثير من معماري اليوم يحاول تطويع مستجدات التعليم للقرن الحادي و العشرين ضمن عمارة القرن التاسع عشر، مما كان له الأثر الواضح في إخفاق المبني المدرسي عن القيام بمهامه. فالمملكة العربية السعودية تشهد في الوقت الحاضر اهتماما متزايداً فيما يتعلق بتقييم أداء الطلاب و تطوير المناهج و البرامج الدراسية و جودة تأهيل المعلمين دون أن يكون هناك تطور نوعي موائم لها فيما يتعلق بالبيئة المادية للمدرسة يجعلها قادرة على إثراء العملية التعليمية.

تهدف هذه الرسالة إلى تحديد البيئات المادية الواجب توفرها في المدرسة لتلبية متطلبات تعليم الحاضر والمستقبل. كما تهدف لتقييم قدرة النماذج المدرسية الحكومية على استيعاب هذه البيئات التعليمية. كذلك تهدف إلى إعداد دليل معماري إرشادي يساهم في تقديم تصور عام عن الخصائص المعمارية للبيئات التعليمية المقترحة. و لتحقيق هذه الأهداف، عرَفت الدراسة أنماط و طرق تعليم و تعلم مختلفة مع التعريف بالأنشطة المصاحبة لها. بناءً على هذه الأنماط و الأنشطة التعليمية تم تقديم تصور للبنية الأساسية للمدرسة ترتكز على خمسة عشر بيئة تعليمية. و لمعرفة مدى قابلية النماذج المدرسية الحالية على استيعاب هذه الأنشطة و البيئات التعليمية، تم القيام بدراسة ميدانية لعينة من المدارس الحكومية. استناداً على نتائج الدراسة الميدانية و اعتماداً على منهج البحث العلمي إضافة إلى الأخذ بالأسلوب الإبداعي في التصميم، تم إعداد الدليل المعماري الإرشادي للبيئات التعليمية.


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**درجة الماجستير في العلوم**

**جامعة الملك فهد للبترول و المعادن**

**الظهران، المملكة العربية السعودية**

**يونيه 2009**

# CHAPTER 1

## INTRODUCTION

### 1.1 Preface

The importance of education as a means toward development has been a worldwide adapted approach for a long time. What is receiving more attention in the last years is what type of education countries should provide their generations so that they are prepared to face the challenges of the third millennium, the era of technology revelation, fast changes, open media, and globalization. As a result, Education systems in most of the countries around the world have been reformed taking in consideration the changes and characteristics of the new era. In addition, it has become a common strategy for countries to link their goals and objectives of their educational systems to the overall development plan of the countries. In spite of that, there is a noticeable gap between the stated goals and objectives of the educational strategic plans (the theoretical part) and the real practice of education in schools. For example, although there is a widespread support for the concept that every student is important in education, the systems reinforce the old practice of favoring a few at the expenses of many.

When school facilities are considered in particular, the gap between educational goals and objectives and the physical environment intended for practicing the goals and objectives becomes even more obvious. This is mainly due to the manner in which these facilities are planned and designed.

Considering the problem of school facilities adequacy in regard to the educational requirements within the Islamic and Arab world is more serious. This is because most of these countries have a relatively short time experience with the formal educational system compared to the west. In addition, there is –at first –a tremendous pressure to accommodate the continuous increasing demand on education from their citizens, and – second – there is a tremendous pressure on these countries to catch up with the developing world. In many cases, this has caused these countries to fall in the dilemma of quantity over quality in the effort to provide more educational opportunities for their nation.

Considering Saudi Arabia in particular, in spite of its welfare compared to other Islamic countries, Saudi Arabia –as several local researches indicated –has suffered from the dilemma of quantity and quality of educational facilities. In contrast to what may be thought at first look, the economic prosperity is one of the main reasons that have led to the current situation being widespread all around the Kingdom. This is because –as highlighted by *Al-Soliman* (1981), *Al-Khafaji* (1987) and *Al-Neaem* (2004) –the rapid development of prototypes design that lacks the positive interrelationship between educators and architects. Consequently, the result has been that both education and school building tend to be developed in a different and isolated manner.

School buildings needs to be visualized with insight to the educational mission, goals and objectives. Thus, there is a need to develop a mechanism by which it is possible to effectively translate the educational goals and objectives into responsive learning settings. These settings must be able to accommodate the various activities intended to achieve the required goals and objectives. In addition, the settings should also be able to satisfy the requirements of the users who are conducting these activities within these physical settings.

## 1.2 Background of the Problem

During the nineties, Saudi Arabia experienced an economic depression, associated with a repaid increase in the population, especially in the youth category (0-15 years old). This category is expected to make up more than 50% of the population by the year 2012 (MOE, 2007). This escalating rate of youth population growth has been exerting a tremendous pressure to cope with the urgent need to provide school facilities that could accommodate such escalating demands. A quick temporary solution adopted during that period was to rent residential buildings, mostly two storey villa type units, and re-adapt them for educational purposes. This was in addition to operating the existing permanent conventional public school facilities. By the year of 2000, rented schools represented 52% of the overall public schools (MOE, 2007).

By the beginning of the third millennium, Saudi Arabia –support by substantial continuous improvement in the national economy –has adopted a series of ameliorative polices in many aspects, and education was one of the main issues to be reformed. Although improving educational performance ranks high on the national agenda, with educators and policymakers focusing on testing, accountability, curriculum reform, teacher quality and related concerns, there is little hard data to inform the debate about which aspects of school and facility design enhance learning and education.

## 1.3 Statement of the Problem

A broad definition of school –as a place –is: an institution designed to allow and encourage students to learn, under the supervision of teachers (Wikipedia). In the context of Saudi Arabia, the school facility defined by the "Educational Policy Document" –the official reference of all educational affairs in Saudi Arabia –as:

*"The exclusive environment intended for educating youths and preparing them in the best way to serve their religion, nation and country"*

*and*

*"The school with all its facilities, resources, systems, and activities should work to achieve the educational objective of the educational policy"*

From the above statements, although they are broad in nature, they clearly define the relation between educational objectives and school buildings within the overall educational policy. On the other hand, while initiatives to improve the current state of education in Saudi Arabia has led to adaptation of new educational strategies that involve implementing a new set of goals, objectives and activities, school facilities –being the place pertaining to achieve such goals and objectives –have remained static. To a large extent, the tremendous pressure to provide educational opportunities for the new generations, and the heavy heritage of rented schools, left a small window to rethink about school facilities and how they could be improved to cope with the evolving educational requirements. Supported by the substantial continuous improvement in the national economy, the current agenda is to gradually reduce the dependency on the temporary rented school solutions and build new permanent public school facilities. However, the main concern with the newly built school facilities is that often their designs follow the same design concepts for the schools that were built during the seventies. In spite of the technical improvements and some of the changes introduced to the adapted school models, the basic unit – the one size fits all classrooms –remains the dominant feature (or concept) shared by all prototype school facilities. In other words, this has resulted in constructing hundreds of prototype school facilities mimicking similar concepts that were adopted for the last thirty years. This is done with the belief that these prototypes are the means to resolve the current and future demands of school facilities.

The existing school models have come short of the requirements of the current and future demands because they are neither satisfying the evolving educational directions, nor stimulated by the new trends in the design of educational facilities. In particular, the existing school models have been strongly adhering to the teacher-centric learning approach, which is the main characteristic of the old perception of educational.

When high schools are considered in particular, the need to experience the new educational directions within a responsive learning environment becomes urgent. The high school period is a watershed for students. After completing high-school, students either continue their educations, or join the world of business. In either case, the educational system supported by the physical environment of the school facilities has to provide the student with the required skills.

The place where the people and programs converge deserves serious reflection and moments of cognition about how it should be planned, designed and operated to facilitate the achievement of the ambitious goals and objectives of education. When the achievement of the goals and objectives of educational becomes the main concern, the quantitative component of building schools should not be the ultimate goal. Moreover, how the goals and objectives could be efficiently translated into a responsive physical environment must be a main concern for educational boards, planers, designers, facilities managers and all school facilities' stakeholders.

The school facilities we are building today must be able to cope with the requirements of the current periods, and should be capable of anticipate the needs of the future. Ignoring the current stock of school facilities, or building new schools based on the current models, will increase the gap between the school facilities and the evolving educational requirements. There is a need to improve the performance of the current stock of school facilities. Also, the design of the future facilities should keep in view the evolving requirements of education.

To achieve that we need first to identify learning methods school facilities have to support to cope with the new requirements of education. Then, we need to identify the

successes and failures of current stock of school facilities –especially the recent ones –by systematically assessing their performance with regard to the identified learning methods. After that, we are ready to visualize the main physical settings of future schools. ***Human needs and requirements emerging from the interaction between the people and the physical settings they are occupying must be a main determinant factor in such a process of assessment. For efficient feed-forward of the obtained results into the next design projects, the assessment process must be more than judgments on historical events. The assessment process must be an instrument of accountability for future design quality.***

## 1.4 Research Objectives

This research aims towards development of optimum school facilities by contributing in bridging the gap between the current stock of public school facilities in Saudi Arabia, and the optimum school facility that is more responsive to the requirements of the evolving educational needs, and the epistemic and the sentimental goals of the users.

The main objective of this research is to develop an approach that facilitates visualizing the physical settings of a future public high-school that is capable of supporting the evolving educational requirements.

Within this main objective in mind, the thesis aims at achieving the following sub-objectives:

1. To identify the activity settings that are demanded by the evolving educational requirements

2. To carry out a case study to assess the capability of the public high-schools in Saudi Arabia in accommodating the identified activity settings

3. To develop series of guidelines pertaining to the activity settings demanded in public high-school facilities. These guidelines will be derived from the analysis of the conducted case study for feed-forward into the design of future school facilities.

## 1.5 Research Questions

The research tried to achieve its objectives through answering three main questions, they are as follows:

1. What are the activity settings public high-schools should have in order to accommodate the new educational directions? And how could these activity settings be developed?

2. Are the existing public high-schools in Saudi Arabia capable of accommodating the identified activity settings? And how do they respond to the requirements of each activity settings?

3. What should be the characteristics of each learning activity settings within public high-school facilities?

## 1.6 Scope and Limitations

- The study considers school facility infrastructures as the place for conducting educational activities. As a result, the process of assessing and visualizing school facilities will primarily focus on the educational adequacy of the school facility and the capability to satisfy humans' needs. Educational adequacy in the context of this thesis is defined as the relationship between the physical condition of the school facility and the various educational goals and activities that take place within the facility.

- The elements of building performance –included in the structure used for the assessment and the development of the guidelines –are adapted from Presier concept of building performance (1988), which is limited to three main elements; functional, behavioral and technical.

- School users participating in the study will be limited to teachers and students, as they are directly involved in the learning process.

- The case studies conducted in partial fulfillment of the first objective are limited to three different prototypes of school facilities found in four high-school facilities within the Dammam Metropolitan Area *(Dammam, Khobar* and *Dhahran* cities).

- The process of selecting the schools' users participating in the assessment is further explained in the research methodology section.

## 1.7 Research Significance

- Schools are a distinctive type of facilities that house a large number of occupants for the purpose of learning, dissemination of knowledge, and developing soft skills for living.

- Learning activities intended to achieve educational goals and objectives are the key to toward identifying the physical settings of school facilities.

- The adequacy of the activity settings composing the school facility are a main factor determine wither the school facility supporting or hindering learning activities, that are intended to achieve educational objectives.

- Humans' needs identified from the interaction of users with the physical settings in which they are conducting the learning activities must be satisfied.

- The quality of the functional, behavioral and technical elements of performance in school facilities needs to be maintained at standard levels; or else they may be distracting elements that may hinder learning and knowledge exchange.

- This research will contribute to raising awareness and fostering commitments among school facility occupants on the impact of the quality of school environment on the achievement of desired educational outcomes.

- The outcomes of this research will contribute to improving the performance of existing school facilities by understanding how they can support and/or frustrate the learning process.

- The outcomes of this research will also contribute to avoiding mistakes in the design of future school facilities through understanding how similar school facilities perform in-use. Successful design features can be also implemented in future projects.

## 1.8 Research Methodology

This section presents the research methodology through which the objectives of the study will be achieved. The methodology is described in the following subsections as follows:

### 1.8.1 Phase One: Develop Activity Settings for High-Schools

The first objective of the study is to develop a range of activity settings capable to accommodate current and future educational requirements. This objective was achieved through conducting the following tasks:

#### 1.8.1.1 Identifying Educational Objectives, with Reference to Saudi Arabia as a Case Study

The intention of this task was to draw general guidelines for selecting the learning methods and activities (the next task) in terms of their supporting the current and future educational requirements. As the study is universal in its goal, and limited in its scope to Saudi Arabia, more emphasis was given to the academic objectives which tend to be common worldwide. For this purpose the following tasks were carried out:

1. Reviewing the educational strategic plan developed by the Ministry of Education that aims at improving the educational system in Saudi Arabia. The review was conducted to extract specific educational objectives related to high-school education from the general goals and strategic objectives of the strategic plan. The goals and objectives of the Strategic Plan are provided in the appendix.

2. Reviewing local/regional and international literature on educational directions and goals. The aim of this activity was to enrich the final set of the national educational objectives, benefiting from regional and international educational trends.

3. Conducting personal interviews with a key personnel from the Ministry of Education for the purpose of reviewing the set of the national educational objectives. The reviewing process entailed adding, removing or modifying the identified set for the purpose of ensuring it applicability to the local context.

The main tasks of this part are highlighted in **Figure 1.1-a.** The task is further discussed in Chapter 4: “Toward Responsive School Facilities”.

#### 1.8.1.2 Identifying Learning Methods and Activities (Learning Modalities)

**"Learning modalities"** include the various teaching and learning methods and strategies practiced by teachers and learners in the process of dissemination and acquisition of knowledge. The aim of this task was to identify a range of learning modalities pertaining to the identified academic objectives, and new educational directions. The outcome of this task was Learning Modality Forms. The form for each

identified learning modality is provided in the appendix. For the purpose of this task, the following sub-tasks were carried out:

1. Reviewing educational literature about various teaching and learning strategies, methods, styles and means used by teachers and learners for the purpose of delivering, dissemination and acquisition of knowledge and skills. The modalities were selected in terms of its supporting to the educational directions and objectives.

2. For each learning modalities two main issues were identified; the objectives gained from each modality, and the learning activities associated with each modality in order to pursue the intended objectives.

3. Conducting personal interview with a key personnel from the Ministry of Education for the purpose of reviewing the set of the leaning modalities. The reviewing process entailed adding, removing or modifying the identified set for the purpose of ensuring it applicability to the local context.

4. Conducting a workshop with selected samples of school's teachers for the purpose of examining and confirming the list of learning modalities. The task also aimed to prepare teachers by exposing them to several teaching and learning methods, which was expected to make them more appreciative to the impact of the physical environment on education.

The main tasks of this part are highlighted in **Figure 1.1-b**. The task is further discussed in Chapter 4: "Toward Responsive School Facilities".

#### 1.8.1.3 Proposing Physical Learning Activity Settings

The intention of this task was to develop activity settings for school facilities based on the identified learning activities. Thus, for each pattern of learning activity there would be an activity settings corresponding to it. For this purpose the following tasks were carried out:

##### 1.8.1.3.1 Grouping the Learning Activities Identified under the Learning Modalities

The identified activities under the various learning modalities were grouped based on the nature of the activities. This was intended to the facilitate identification of the required physical characteristics for each group of activity. For this purpose the following tasks were carried out:

1. Conducting literature review about the nature of the activities high-school and the facilities need to support them.

2. Utilizing researcher reflection and judgment based on the accommodated knowledge.

Further discussion about this part is provided in Chapter 4, under the subtitle: “Grouping of Learning Activities”.

#### 1.8.1.3.2 Identifying/Developing Physical Characteristics

The intention of this task was to identify/develop specific physical characteristics suitable for specific sub-activities pertaining to certain activity group. The combination of the several characteristics pertaining to each group of activity has generated the overall physical features of a particular activity setting. The result of this task was Preliminary Activity Setting Forms which were reviewed later by schools client and users (the Forms are provided in the appendix). For this part the following tasks were carried out:

1. Conducting literature review about the type of setting high-school facilities should support.

2. Utilizing researcher reflection and judgment based on the accommodated knowledge. (Further explanation are provided under developing activity setting section)

This part is further discussed in Chapter 4. **Figure 1.1-c** shows the main activities conducted in this part of Phase One.

***Figure 1.1-a:*** *Phase 1, Task 1: Identifying Educational Objective*

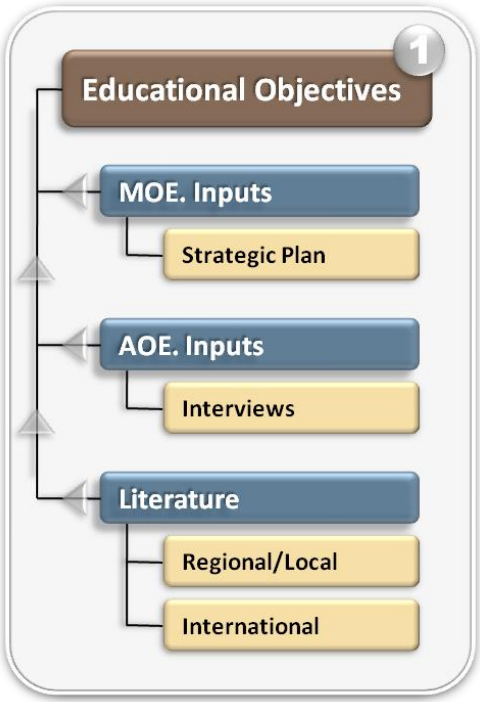



***Figure 1.1-b:*** *Phase 1, Task 2: Identifying Learning Modalities*

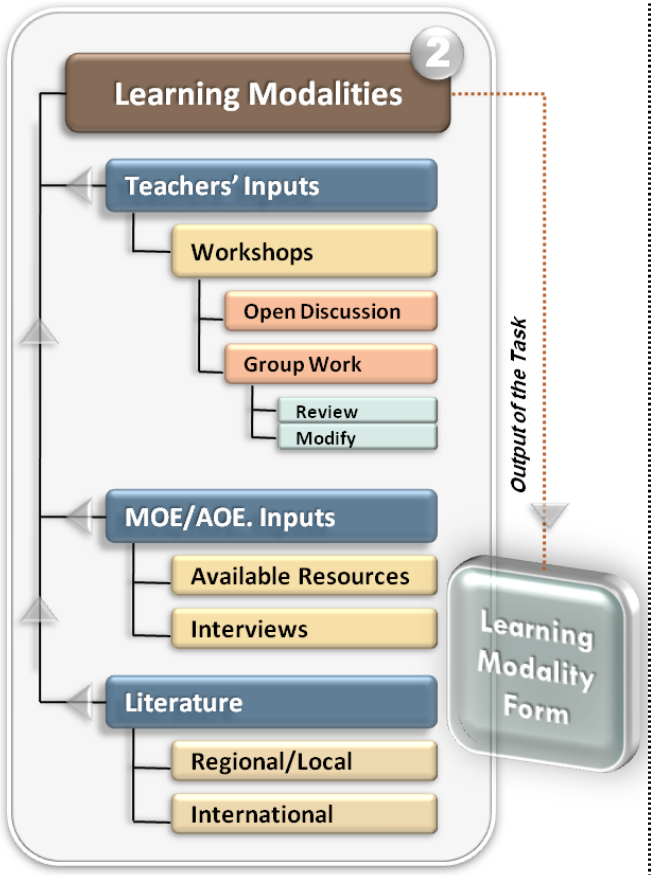
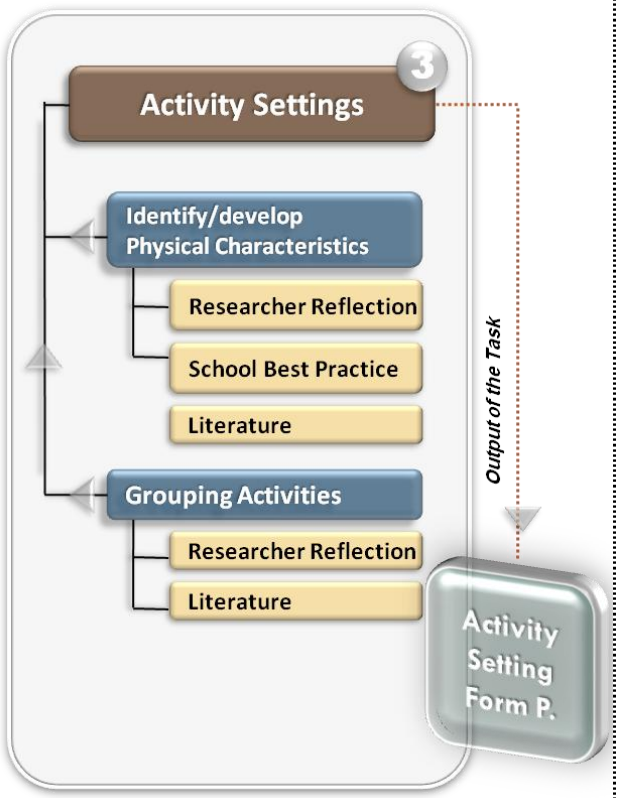



***Figure 1.1-c:*** *Phase 1, Task 3: Identifying Physical Characteristics*



### 1.8.2 Phase Two: Case Study: Assessing Selected Sample of Public High-School Facilities

The aim of this phase was to evaluate to what extend the selected school facilities are capable of accommodating the identified learning activity settings, and satisfy user's needs arise from conducting learning modality in the schools. For the purpose of systematically assessing the school facilities and for the purpose of forwarding the obtain results into future school designs, the assessment process was structured based on proposed learning activity settings. The areas of concern for the assessment included three main elements of building performance: functional elements, behavioral elements and technical elements. Because the state of the current stock of public schools with regards to the identified activity settings would be the reference and the initiating point toward elaborating on the activity setting, there were two chapters dedicated to the assessment. Chapters 6 discuss the state-of-the art in assessing building performance. And, Chapter 7 discuss the actual state of the current stock of schools with regards to the identified activity settings.

Under each proposed physical setting, a number of performance criteria were identified to ensure that the required physical settings are best described. The data needed to achieve the objectives of this phase was generated from a multitude of sources. This was to increase the inner validity of the obtained data. The data collection methods included:

1. Conducting interviews with key personnel in the Ministry of Education for the purpose of gaining insights on the factors that may impact the performance of school facilities. Interviews were also conducted with the administrators of the selected sample of public high school facilities.

2. Development of an audit form to be used by the researcher during a walk-through inspection of the selected sample of public high school facilities.

The walk-through tours were conducted for the purpose of evaluating and documenting deficiencies in facility performance that hinder the acquisition of the identified learning modalities. As-built drawings for the selected sample school facilities were obtained and analyzed to study school layout.

3. Conducting focus group discussions with a selected sample of teachers to gain their insights on the performance of the functional and behavioral elements that facilitate and/or frustrate the acquisition of the identified learning modalities in the selected public school facilities.

4. Development of a user satisfaction survey to subjectively assess the provision of the behavioral, functional and technical elements of performance for the selected sample of the public high-school facilities. The surveys were distributed for both school's teachers and students.

**Figure (1.2-a)** highlights the main activities carried out under this part.

#### 1.8.2.1 Data Analysis

In this task, data generated from the above-mentioned phases were synthesized, analyzed, and reported in order to provide a complete and detailed critique of the levels of performance for the fifteen main physical settings based on the three main elements of building performance (functional, and behavioral and technical) from the perspective of whether they facilitate and/or frustrate the acquisition of the identified educational objectives and the agreed upon learning modalities in the selected public school facilities. The result of the analysis is presented in Chapter 7, while detailed results and their implications are presented in Chapter 8. **Figure 1.2-b** highlights the main activities of this part.

### 1.8.3 Phase Three: Develop Series of Guidelines Pertaining to each Proposed Activity Setting

The intention of this phase was to provide design guidelines pertaining to each proposed activity setting based on the preliminary activity setting forms obtained from phase one and the analysis of the data obtained from phase two. For this purpose the following tasks were carried out:

1. Editing the activity setting forms obtained from phase one. Insight of the assessment phase and the data analysis, the activity setting forms were reviewed to ensure it is relevant to context of Saudi Arabia and to clarify ambiguity raised in the assessment possess.

2. Conducting workshops with school users; teachers and students. The intention of this task was to allow the primary school users (teachers and students) to participate in the process of identifying the physical requirements and users' needs arise from conducting the learning activities in school facilities. The task also aimed to contextualize the developed guidelines to the Saudi Arabia environment and to confirm its relevant to schools' users. Participants' responses to the proposed alternative solutions are provided in the appendix. Their responses were reflected in terms of the level of agreements with the propositions.

The main activities included in the workshop were:

a. Running a presentation about the recent trend in the design of the educational facilities and school buildings develop by the researcher.

b. Conducting informal open discussion.

c. Dividing participants into small groups to work affectively in evaluating the activity setting forms.

d. Developing the final list of the guidelines. After the modification and confirmation of the characteristics of the activity settings, the final list of the guideline was elaborated more through reviewing the literature and researcher own reflection.

3. Elaborate on the activity settings. Based on the preliminary activity settings forms, assessment results, and users' response to the proposed guidelines, the researcher conducted an extensive literature review related to future school and school best practice. Researcher reflection on these elements was finally reflected as design guidelines.

This part is further discussed in Chapter 8. **Figure 1.2-c** highlights the main activities under this part.

***Figure 1.2-a:*** *Phase 2, Task 1: Case Study*

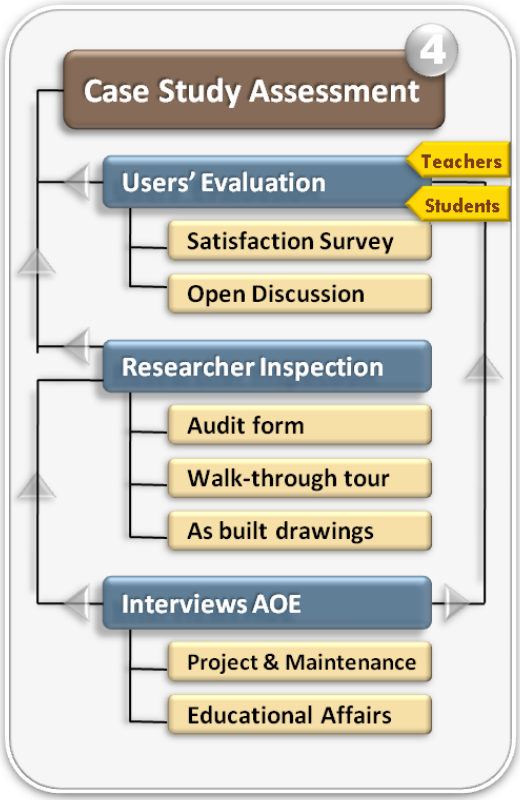



***Figure 1.2-b:*** *Phase 2, Task 2: Data Analysis and Implications*

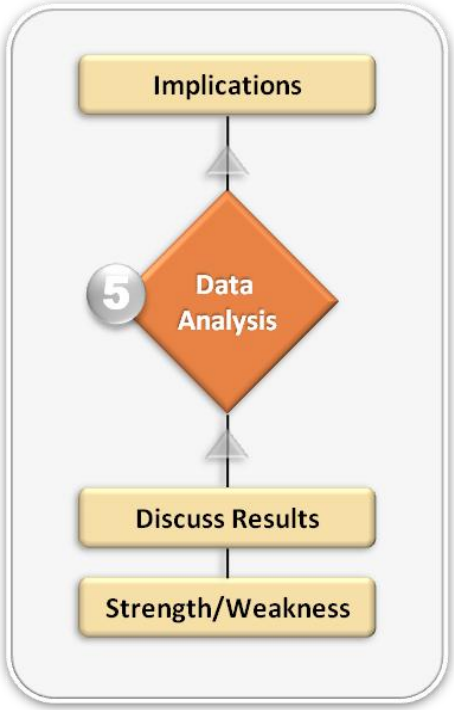
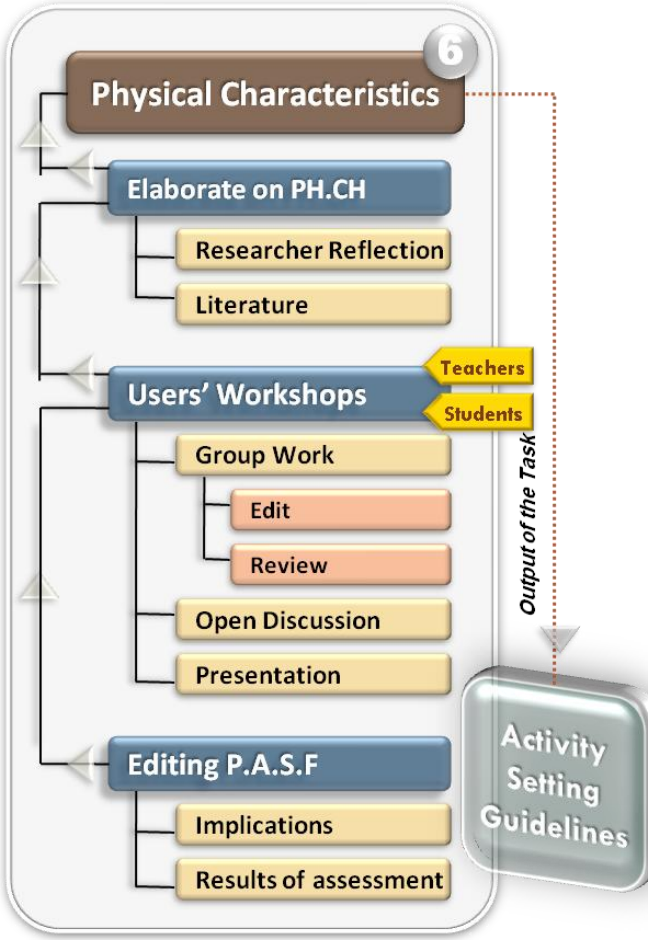



***Figure 1.2-c:*** *Phase 3: Identifying Physical Characteristics*



## 1.9 Previous Studies

Considering the Arabic world, although a lot of work can be found in educational literature and the new direction of education, there is a clear shortage in the work related to educational facilities and school buildings in particular. This is clearer when addressing the issue of future school and the required physical environment. Within the context of Saudi Arabia, the researcher found three main researches which were conducted in the fulfillment of Ph.D. requirements.

The first reviewed work done by *Al-Soliman, Tarik*, in 1981. The study reviewed the history of Saudi Arabia educational system and the different development stages of it. It was also discussed the social and economic changes that affected the educational system. In addition the study presented the planning process of decision-taking within the educational system, and how the school facility is produced within the system. The study evaluated the school facilities from three main perspectives; school principles, maintenance superintendents and directors of engineering sections (A/E). One of the main results obtained from the study was the unbalanced between the quantitative and qualitative components of the educational system in various aspects including school facilities.

The second study conducted by *Sarhan, AbdulAziz*, in 1986. The purposes of the study were to evaluate the elementary facilities in *Makah* Schools District and determine if the physical facilities were adequate for schools' teachers, officials, and the principle. In addition, the study aimed to provide recommendations regarding what could be made to improve the physical facilities in the elementary schools in light of Saudi Culture. The study addressed schools design in general with more emphasis on safety, security and environmental aspects. The main obtained result was safety and health in school facilities needs a lot of improvement, and learning resources are insufficient. The recommendations were particularly related to safety.

The third study conducted by *Khafaji, Osama*, in 1987. Based on the literature review about school facilities and the review of the local architecture of Saudi Arabia, the aim of the study was to propose a general set of requirements in the form of a "design brief" to help in the updating of the architectural response to the existing and future educational needs in **intermediate schools** in Saudi Arabia with particular reference to ***Jeddah***. Some of the main tasks conducted in the study were:

- To assess the architecture of school samples with regard to climate situation, structure, function, environmental aspects (lighting, acoustics, ventilation), and decoration.

- To assess the attitude of the users (teachers) towards their present school buildings

Main results obtained from the study were:

- Interrelationship ideas behind the building do not reflect the efficient qualitative and quantitative response to the educational system which was required. This was mainly due the isolated manner in which education and school buildings were developed

- Environmental conditions in all examined school buildings were generally poor.

- The spatial environment (hierarchy and layout) are usually dictated by the modular grid and structure rather than their functions.

- Utilization of specialized areas was very low.

## 1.10 Structure of the Thesis

The structure of the thesis is as follows:

**Chapter 1: Introduction;**

This chapter presents a background information and introduction to the topic of the thesis. It presents the statement of the problem that initiates the need of the work, and states the objectives pertaining to resolve the problem. The significance of the thesis is highlighted in this chapter, and the scope and limitations of the thesis are clearly declared. It also documents some of the previous studies related to the subject.

**Chapter 2: Literature Review: Conventional Schools and the Inevitability of Change;**

It consists of two main parts. **Part one** reviews two main issues. First, it gives an overview the old perception of learning and the emerging of what is called "the conventional school model" from a universal domain. In addition, it reviews some of the main reasons that cause this model to survive. The other issue discussed is the educational system in Saudi Arabia with particular reference to public high school. The chapter addresses the main developments within this type of school. It ends by presenting the difficulties that facing the current educational system in Saudi Arabia with particular reference to the physical environment of the schools.

**Part two** provides an overview of the new perception of education and learning that is derived from the recent research on human mind and how people learn. It also discuses some of the main changes that are influencing the real practice of education and learning in schools with particular reference to Saudi Arabia. Then, it discus the impact of the physical environment on learning process and some of the

debatable issues related to schooling. It concludes with discussing the future direction of education in Saudi Arabia and how it would influence the physical environment of the schools.

## Chapter 3: An Approach toward Responsive School Facilities: Learning Activities and Activity Settings;

It consists of two main parts. **Part one** discuses in details the tasks intended to achieve the first phase identified in the research methodology. It covers three main topics. The first is educational objectives and goals and their influence on the educational process and the physical environment. It also, highlights the process of identifying the goals and objectives. The second topic is learning modalities. This part reviews teaching strategies, methods and learning styles. It also, discuses the process of identifying learning modalities and the learning activities associate with each modalities. The last topic covered is the process by which the required activity settings are identified. The relation between the learning modalities and the proposed activity settings is also discussed.

**Part two** presents the state-of-the-art in school facilities within the real practice. The information obtained from the review is filtered according to the proposed activity settings, so that each setting is addressed and covered in terms of functional, behavioral, and sometimes technical considerations. The chapter is divided into fifteen main sub-sections. The last sub-section entitled "High-Operational Performance Learning Setting" is further detailed because it is more technical oriented that tends to be similar for all schools.

**Chapter 4: The Status of the Public Schools Facilities in Saudi Arabia: A Case Study;**

It consists of two main parts. **Part one** reviews building assessment methods with particular reference to school facilities. It starts with building evaluation methods and the performance concept. Then it reviews the literature and the practice of Post-Occupancy Evaluation (POE) and its applications and benefits within educational facilities. The chapter also, briefly reviews the three main elements of building performance: functional, behavioral and technical.

**Part two** presents the actual performance of the physical environments of the selected sample of high-school facilities based on the data obtained from the assessment. Further, it presents users' needs required to achieve the intended educational objectives and conduct the identified learning modalities. It also, presents a comprehensive critique about the performance of the physical environment in light of the identified learning modalities.

**Chapter 5: Developing Design Guidelines For The Identified Activity Settings;**

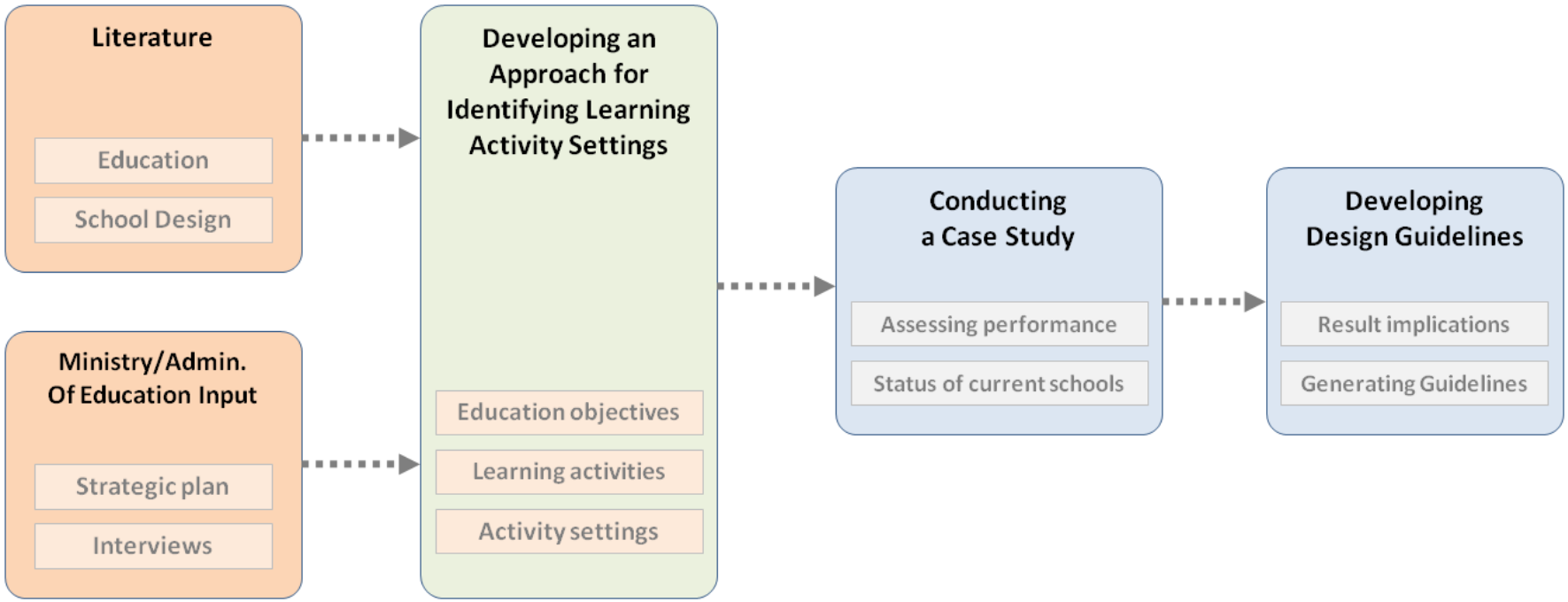
Each section in this chapter presents two main parts. The first part provides the implications of the results obtained from the assessments on the educational process and users' performance. The second part presents a set of recommendations pertaining to enhance the quality of the current school facilities, and benefit from the findings of the assessment for feed-forward in the design of future high-school facilities in Saudi Arabia. The chapter is structured based on the identified activity settings.

**Chapter 6: Conclusion;**

This chapter states the main conclusions and inferences obtained from the work of the research and directly link them to the research questions. Also, it summaries the main contributions of the thesis in a concise paragraphs. It ends by indicating issues for further work within the area of thesis focus.

Figure 1.3 shows the overall structure and methodology of the thesis.

***Figure 1.3**: The Overall Structure and Methodology of the Thesis*



# CHAPTER 2

## LITERATURE REVIEW: CONVENTIONAL SCHOOLS AND THE INEVITABILITY OF CHANGE

### 2.1 Overview of Conventional School Models

#### 2.1.1 The Old Perception of Learning and the Conventional School Model

From ancient times, the form of the physical setting of school building reflects the goals and activities of building users (Sanoff 1981). When the goal of learning was to obtain basic knowledge about reading and writing, a single enclosure with basic structural requirements was enough to deliver the task of learning. The late 19 century and early 20 century, a general perception about how humans learn was formed by a group of theories initiated primarily by psychologists. The "behaviorist-associationist approach" had dominated –for many years –the thinking in how people learn (OSUH, 2001). It views learning as building up of habits of association. Thus, repetition, especially followed by positive reinforcement, promotes learning. As a result, teacher breaks up knowledge into small, logically organized bits of information and provides reinforcement for students to learn. At the same time, the Industrial Revolution influenced educational systems' policy by the widespread application of bureaucratic theories in manufacturing companies. Such perception of learning which considers teacher as the distributor of knowledge has worked very well with the "factory model"

school that ensures teacher-centric position and facilitates teacher control over classroom. As a result, the industrial movement had a profound effect on the designs of school buildings (Kowalski, Theodore J. 2001). This effect could be traced even on the overall plan of the school were similar classrooms units distributed along a long corridor, similar to the production line in conventional factories. Both the educational philosophy adopted and the physical environment of school facilities have contributed greatly to the survival of each other. At that moment, the milestone of what is called the "conventional school" building emerged. Educators at that time considered students as products and schools as the factory, or the plant that was producing these products (Sanoff 2001).

### 2.1.2 Reflection about Conventional Schools: The Learning Environment within Classroom

The classroom represents the greatest symbol of educational philosophy in conventional schools. It has composed the primary building unit of the school building and space layout. The assumption behind the conventional classroom was that a pre-determined number of students will all learn the same thing, at the same time, from the same person, in the same way, and in the same place for several hours each day. (Nair and Fielding 2005) To control the quality of the products (the students in the conventional system), the classroom was organized in rows headed by the teacher who had a central dominant position to facilitate supervision and control over students' behavior. The spatial organization of the classroom ensured that teacher was the only true source of information. As a result, there was only one way to transfer curriculum; from the active node 'the teacher' to passive receivers 'the students', what is known as teacher-centric approach. More or less, the role of the students was to watch what adult do rather than doing the learning processes themselves. In such an atmosphere, there was no need to think about alternative physical settings that support variety of learning modalities since most of the work was done by one person; the teacher. As a result, the number of students occupying the classroom was not critical as soon as the teacher had the ability to control the class regardless whether all students absorbed what was happing or not. This

has been ensured by the grid layout of the classroom that does not allow strong relationship between the teacher and the individual student, or the social interaction of students as a group. So that it was normal to find out a classroom with 30 to 40 students or even more (Lackney 1995).

The basic form of classroom layout is a grid system of narrow passages surrounding students from all sides. Collaboration between students is considered as cheating, and discussing issues with peers is misbehavior. The territory of each student is no more than the desk in front of him and the hard wooden plate he sits on. Being outside the classroom means running away from learning. There is no space within the school designed for students to exchange knowledge and ideas spontaneously, or to be alone for individual study or for cogitation, reflection, or a place to socialize and develop soft skills with others. A sense of Commitment and belonging to the place is the last message the physical environment may convey to their occupants. The most preferred sound students waiting with full interest to hear is the bell calling the day to cross out the long narrow boring corridor in a few seconds.

> *"The real test of a good environment is if people are there when they don't have to be there".*
>
> *Harold L. Hawkins*

#### 2.1.2.1 The Survival of the Conventional School Model

From 1900 to 1950, the instruction methods and the physical settings of the classroom underwent very little change (Spring, 1994). Due to this long period that associated with static nature, the monumental classroom with its rows of desks became so canonized that an entire industry of school furniture was created, the thing that has contributed to the survival and dominance of the conventional classroom up to now (Sanoff 2001). As demonstrated by The American Institute of Architects, in addition to

the repeated classrooms that are exactly the same, the conventional design practice organizes the school environment around the administration area and the specialized program rooms that are connected by horizontal and vertical circulation routes in an enclosed system. While this system reinforce the concept of perceiving the school setting as places for moving through to get from one activity setting to another, the school environment need to be perceived as places where the entire system supports knowledge and action so that learning extends across and between settings. The final result of this long practice has prevented planners from even thinking about school without the repeated classrooms and the long corridor linking them.

#### 2.1.2.2 Economical Consideration for the Conventional Model

From an economical view point, the efficiency of the enclosed school facility system is based on 'net-to-gross' ratio. The most efficient school facility is the one that keep this ratio as low as it could be. The problem as Prakash Nair (2005) mentioned in his article "the great learning street debate" is in what included in "net" and what is considered as "gross". It seems that all spaces that do not look like a classroom have been considered as having no educational value. Consequently, utility areas including circulation are considered as "gross" areas and only program areas are considered as "net" areas. Based on this classification, school building which could utilize only 60% of its area for learning is considered efficient!

What if the school facility were designed in such a way that mechanical staff is exposed to demonstrate mechanical concepts, and the electrical network is transparent to explain electrical knowledge, and the outdoor landscaping is a lab for botany science, and the whole school is as an open textbook? If it is possible to do so, by how much would the 'net-to-gross' ration could be changed.

### 2.1.2.3 Teachers' Settings within Conventional School

On the other hand, the physical settings of most of these schools are not designed for collaboration or collegiality. Collegiality as defined by Thomas Hoerr R. (2000) means teachers working with and learning from one another as professional, as colleagues, as partners. Seldom is it possible to find spaces such as conference room prepared with comfortable chairs, a large table and state-of-the art technology equipment designed for teachers to work and exchange ideas. In contrast, the gathering place –and may be the only place– for teachers is the lounge which is typically a crowded place to eat and relax. As Barth (1990) believes; the most important factor in determining the quality of a school is the nature of the adult relationships within that school. To a large extent, conventional schools failed to satisfy the personal and social needs of their faculty (Gary Moore 1995). Teacher work in isolation from each other and located away from their students. Spatial adequacy and quality such as work station, personal storage, office equipments; and spatial transparency, outdoor indoor blending and flexibility are – if available– kept to minimum.

To sum up this part regarding conventional school facilities, it is good to consider what Theodore Kowalski (2001) mentioned about school adequacy.

> *"Adequacy also can be studied from two separate perspectives: construction adequacy and program adequacy. A building could meet minimal construction standards and still not be large enough to support programs deemed essential by the community"*

### 2.1.3 The Educational System in Saudi Arabia and the Development of School Facilities

Since its early days of establishment, Saudi Arabia has witnessed a tremendous growth and development in many aspects. Education was one of those aspects that aimed at making a qualitative transition from semi-illiterate communities to a unified nation where basic education becomes mandatory for all citizens. An increase in the number of school facilities, over the past fifty years from 341 elementary, intermediate and secondary schools (High-School) in 1954, to 10,659 school facilities in 2001 is a sensible quantitative evidence that demonstrates the Kingdom's noble commitment towards education *(Al-Fouzan*, 2004).

Throughout the history of educational development in the Kingdom, the built form of school facilities could be considered as a true reflection of the educational process carried out in them. Starting from basic shelters that were intended to teach basic skills, and ending with the reinforced concrete building intended to teach advanced skills and various sciences. Thus, to determine the level to which the current stock of school facilities is adequate enough to support educational purposes is much related to the adequacy of the educational system, policy and philosophy intended to practice them.

#### 2.1.3.1 Brief History of Saudi Arabia Educational System

Saudi Arabia's first ruler, King Abdul-Aziz bin Saud, regarded education as a means to foster national unity and to enlighten the Saudi people. In 1925, public education did not exist. The authority and responsibility of education was given to the newly established Directorate of Education. Similar to many others Arabic countries at that time the educational systems –looking for a shortcut toward education –they adapted the traditional western system of general education. Then, depending on the cultural and religious heritage, each country had tried to insert provisions that would suit its own situation *(Khafaji*, 1987). In Saudi Arabia at particular, the first educational system was

modeled on Egypt's system, which, in turn, was heavily influenced by the French educational model (StateUniversity.com). The first high school "*Tahdeer Al-Baathat School*" was established in 1935, to prepare graduate for a university educational outside the Kingdom (StateUniversity.com). In 1952, the United Nations reported that Saudi Arabia had 306 elementary schools, but illiteracy was between 92 and 95 percent. To overcome this problem, a Ministry of Education was established in 1953. The main role of the ministry was to expand and modernize the educational system and resources. To facilitate the work of the Ministry of Education, the Kingdom was divided into school districts, each governed by a superintendent assisted by a technical staff. Each district works under the direct supervision of the central authority in Riyadh.

In 1958, the Saudi kingdom adopted a uniform educational policy in cooperation with other Arab countries that provided for a six-year compulsory elementary education, a three-year optional intermediate education, and a three-year optional high education. Education is free but not compulsory beyond the elementary level.

#### 2.1.3.2 The Principles and the Special Characteristics of the Saudi Education

Islam is the most influential principle in the educational system. Seeking knowledge is mandatory for each Muslim. Significant persistence in the study of Islam to search, question, and inquire about all matters related to explore the surrounding environment in all possible means. In 1970, the Higher Committee of Educational Policy formulated the "Educational Policy Document in Saudi Arabia". The document is considered the main official reference of the educational directions in Saudi Arabia (*Educational Policy Document, 1999*). The general principles included the following responsibilities:

1. Strengthen faith in God and Islam and in Mohammed.

2. Foster a holistic, Islamic concept of the universe.

3. Emphasize that life is a stage of work and production to invest full understanding of and faith in eternal life.

4. Proclaim the message of Mohammed.

5. Instill Islamic ideals.

6. Engender faith in human dignity.

7. Reinforce the duty of each Muslim to see education and the duty of the state to provide education in it various stages within the state's capacity and resources.

8. Incorporate religious education and maintain Islamic culture at all educational levels.

9. Integrate Islamic orientation in sciences and knowledge in the curricula and teaching.

10. Stimulate human knowledge through Islam to raise the nation's standard of living.

11. Foster fundamental beliefs.

12. Teach the importance of Saudi history and the preservation of the Islamic religion.

Education in Saudi Arabia has four special characteristics: an emphasis on Islam, a centralized educational system, separate education for men and women, and state financial support (StateUniversity.com).

#### 2.1.3.3 Regular Public High-School

The objectives of Regular High Education are religious orientation, development of a scientific attitude and academic practices, preparation for higher education, and the preparation of non-college bound students. A regular secondary education is three years, for students' ages 15 to 19 years old. A general curriculum is studied the first year. Students select from either arts or science curriculum for the two remaining years (view schools offer more options). Courses are offered in Islamic Studies, Arabic Studies, Social Studies, the Sciences, Mathematics, English, Physical Education (*Zydan*, 1982). Table 2.1 shows typical weekly timetable for normal High School.

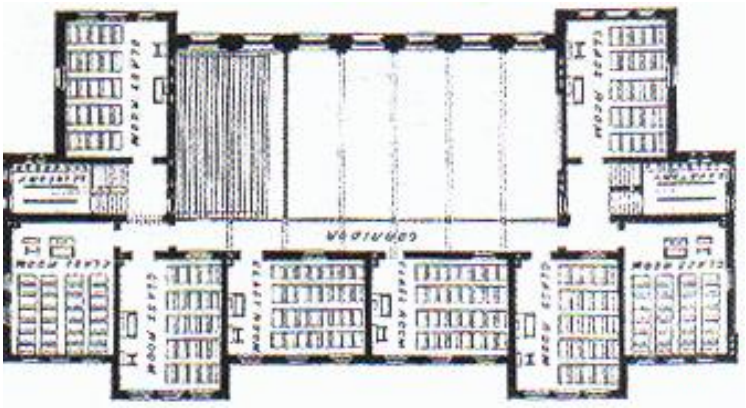
***Table 2.1:*** *General High-School Education for Boys: Weekly Lesson Timetable (each teaching period lasts 45 minutes, Source: UNISCO-Ibid)*

| Subject | Number of weekly periods in each form | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Religious ed. and Arabic | | Admin. and social sciences | | Natural sciences | | Technical sciences | |
| | I | II | III | II | III | II | III | II | III |
| Islamic education | 5 | 12 | 12 | 6 | 6 | 5 | 5 | 5 | 5 |
| Arabic language | 6 | 9 | 9 | 4 | 4 | 3 | 3 | 3 | 3 |
| History | 1 | 1 | 1 | 2 | 2 | – | – | – | – |
| Geography | 1 | 1 | 1 | 1 | 1 | – | – | – | – |
| Psychology | – | 1 | – | 1 | – | – | – | – | – |
| Sociology | – | – | 1 | 1 | 1 | – | – | – | – |
| Management | – | – | – | 2 | 3 | – | – | – | – |
| Economics | – | – | – | 1 | 1 | – | – | – | – |
| Accounting | – | – | – | 2 | 2 | – | – | – | – |
| Sciences and technical sciences | – | – | – | – | – | – | – | 14 | 14 |
| Physics | 2 | – | – | – | – | 4 | 4 | – | – |
| Chemistry | 2 | – | – | – | – | 4 | 4 | – | – |
| Biology | 2 | – | – | – | – | 4 | 4 | – | – |
| Earth science | – | – | – | – | – | 1 | 1 | – | – |
| Mathematics | 5 | – | – | 4 | 4 | 6 | 6 | 5 | 5 |
| English language | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Computer science | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Library and research | 1 | 1 | 1 | 1 | 1 | – | – | – | – |
| Civics | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Physical education | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Activities | 2 | 1 | 1 | 1 | 1 | 1 | 1 | – | – |
| **Total weekly periods** | **35** | **34** | **34** | **34** | **34** | **36** | **36** | **35** | **35** |

### 2.1.3.4 The Development of Public School Facilities in Saudi Arabia

The early built forms of schools which were available in the region were barely sufficient for teaching basic literacy skills. They were merely shelters, known as "*Katateeb*", protecting students and teachers from the elements. In many cases the *Katateeb* did not have tables and chairs, and sometimes, the teaching was carried out under trees. By the beginning of the establishment of the Kingdom in 1925, the newly established Directorate of Education had the direct supervision over schools. The first step to improve school was to buy or rent houses and adapt them for educational purposes. These rented schools had suffered from the shortage of basic learning spaces and basic utilities. In addition there were many concerns about ventilation, lighting and the availability of supporting spaces such as eating area and sport facilities. The period from the beginning of 1953 and the early 1973, had represented a main movement in the history of the educational system and the school facilities. By 1953, the Ministry of Education has replaced the Directorate to overcome the illiteracy, and to accommodate the new introduced subjects such as languages and science. In addition to that, the educational system was meant to improve the overall quality of the education (StateUniversity.com). In response to that, new school buildings were constructed for the aim of education. Similar to the beginning of the educational system, the early built up form of these schools missed the clear vision. The period of the 50s and 70s was not of great local specialty. This was due to the unavailability of local architects, which justified the idea of adapting schools models from the west or the Arabic countries that preceded the Kingdom in this matter. As a result, new school models appeared in form of "U" and "L" shapes, very close to the school model developed in England in 1911 (Robson School, Figure 2.1). *(Al-Naeam, 2004)*

***Figure 2.1**: Robson School Floor Plan, England, 1911 (Sources: Albenaa, 2004)*



The beginning of the seventies is considered as a remarkable period of the development of school facilities. Within this period the Kingdome witnessed an economic booming associated with social changes as a result of the previous effort to improve the education. At that time, the country was prepared to open toward the modern world, and the educational system represented the symbolism in this development. The school buildings were used to foster this direction, at the same time it was intended to reflect the uniqueness and the social value of the community *(Al-Naeam*, 2004*)*. Thus, the design of the school has tried to balance between these two desires through the adaptation of the west model of schools (which represent the modern component at that time) and the inner courtyard which is one of the main features of the local architecture in the Kingdom at that time. The result of the effort was modified conventional school model (discussed before) with some local architecture features. Figures (2.2, 2.3) show example of these models.

***Figure 2.2**: Floor plan, Example of School Models in the Seventies*

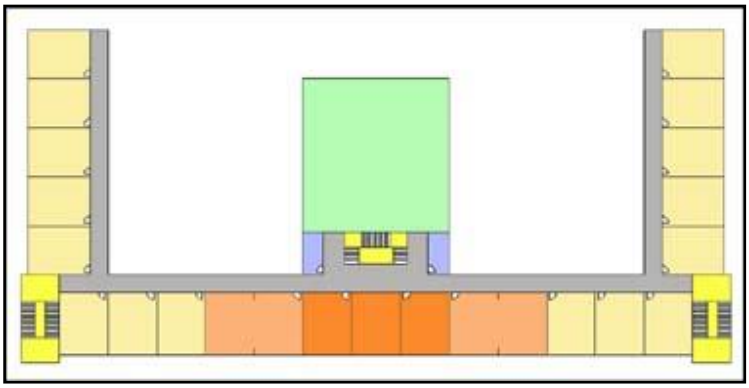
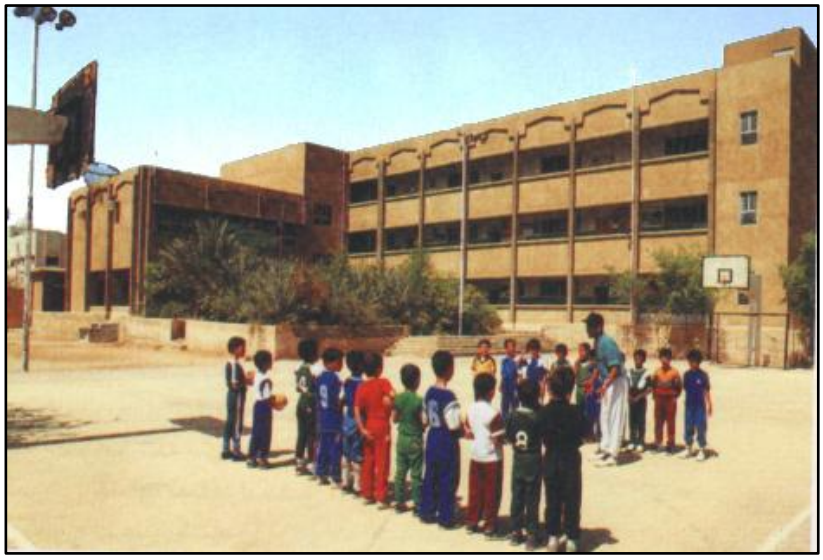


***Figure 2.3**: General View, Example of School Models at the Seventies*



Supported by the great economic prosperity, and forced by the immediate need to accommodate large numbers of students, design professionals during the seventies, came up with a series of prototype solutions based on the mentioned concept for the school facilities. These prototype solutions were mass constructed throughout all regions in the Kingdom (*Al-Naeam*, 2004). This period has composed the basic image of the school facilities in Saudi Arabia in its modern sense.

#### 2.1.3.5 The Survival of the Current Model of School Facilities in Saudi Arabia

The adherence to the conventional school models is a common phenomenon that can be traced in many countries worldwide. Three main general factors have supported this practice worldwide. (1) The pre-determined image about school facilities (Lackney, 2001, Nair, 2006). (2) The way in which school facilities have been designed and developed (*Khafaji*, 1987). (3) The entire industry of school furniture that strongly adheres to the conventional model (Sanoff 2001). In addition to these general factors, each country had its own factors that influenced the survival of the conventional school model. The following is a brief review about the case in Saudi Arabia.

The period of the 80s in the last century witnessed increased number of the reports that criticized the educational system worldwide. As a result, many developing countries have implemented reform to their educational systems toward better education. In contrast to what happened in the seventies, the late 80s witnessed an economic depression. By the beginning of the 90s, the economics condition got worse due to the second Gulf War. The government at that time was under great pressure. First; it should respond to the worldwide educational reform direction, second; it should provide more educational opportunities to accommodate the increasing demand in education. Third; it was difficult to secure the required financial support special when the concern was directly related to spend more money, as the case in constructing schools. A quick temporary solution adopted at that period was to rent residential buildings, mostly two

storey villa type units, and re-adapt them for educational purposes. This is in addition to operating the existing permanent conventional public school facilities. By the year of 2000, rented schools represented 52% of the overall public schools (MOE, 2007). Within this period, although many new schools have been opened, most of them were rented houses. The main concern at that time for all the components of the society including the politicians were to get rid of these rented schools. At the same time the only available model was the conventional school model.

Due to the severity of the problem of the school buildings, a national plan for public schools was developed in 1996, in order to resolve the problem in the long run. The plan consisted of three main components (DMBSE, 1997):

1. Constructing 300 schools each annually for ten years.

2. Securing 100 lands for building new school annually.

3. Maintaining 400 schools annually, in addition to operating and housekeeping of the current stock of schools.

In addition to the economic factor and the pressure to provide more educational opportunities, the problem of the facilities –as indicated by many researchers addressing this issue -lay in the manner by which the design is developed. The education directions and the schools' design have been developed in isolation.

The need to provide many an inexpensive solution left the task of developing the school to the architect. It has been assumed that he will perform the necessary miracles to give an ultimate solution to the problem of supplying the necessary buildings quickly and cheaply (Khafaji, 1987). The final result of such practice have been that in spite of some technical improvement (ex: quality of building materials) and the addition of some spaces

(ex: air-conditioned sport hall) the main concept of the school –the one size fit all has remained the dominant feature.

By the beginning of this century, Saudi Arabia has witnessed a continuous improvement in the national economy. As a result, the efforts to evaluate the educational system have become more visible, which has facilitated the development of a strategic ten years plan for education, starting from 2004. Although the plan adapted new educational goals and objectives, it basically has committed to archive the goals of the national plan of public schools developed in 1996. This has been led to constructing hundreds of school buildings similar –to large extent –to what was available.

In 2006, a pioneer project initiated and supported by King Abdullah called "*Tatweer*" was introduced. The project aims to effectively integrate and implement the use of technology in educational process. Although the project is significant in its goals, it has been planned to be implemented in the existing school models. There is no suggestions provided to develop alternative schools design that may be need to accommodate the extensive use of technology, the things that imply the satisfaction with the current model of schools in spite of its constrains.

#### 2.1.3.6 Difficulties of the Educational System

Educational difficulties in general can be divided into two main types (*Al-Rasheed*, 1996): inner difficulties; such as continuous student's failure due to curriculum difficulty or inability to match student's need, or outer difficulties; such as insufficient financial support, and increasing the demand in education above the capacity of the system. Most often, the outer difficulties are related to the social and economic changes. In the following is a brief list of some of the difficulties of the Saudi Arabia educational systems. (*Al-Hamed and Others*, 2002) (*Al-Rasheed*, 1996*)* (*Gamber*, 2006) (*Al-Ageal*, 2007) (*Al-Aouad*, 1998) (KACST, 2007) (*Zaher*, 1999)

1. Incapability of the existing school facilities to accommodate the continuous social demand in education

2. Shortage of qualified teachers, in terms of academic abilities, social communication and management skills

3. Limitation of technical and vocational education within high-school level

4. Limited role of teachers, with more emphasis on examinations

5. Dominancy of direct teaching that depend on indoctrinating and memorizing

6. Minimum use of teaching and learning strategies

7. Weakness of the relation between the teachers and the students (commander and soldiers)

8. Inability to cope with the needs and capabilities of individual learners

9. General weakness in all fundamentals of the high-school graduates

10. Weakness in the sense of belonging to the nation and its values for most graduates

11. High ratio of failure and discharge from school (in 1992, the ration for high-school was 47%, source: Al-Hamed, 2002)

12. Centralization of the educational system, which increase bureaucracy

13. The methods of assessing students' performance limited to cumulative examination

14. Limited implementation of information technology and computer in the learning process

15. Rigidity of the curriculum and courses' contents, which resist change and diversity of learning methods

16. Prevailing quantitative measures over qualitative one

17. Inability to fulfill most of the society needs; academic, vocational, cultural and art

18. Inability to achieve the stated goals an objective of the education

#### 2.1.3.7 Shortcomings of the Current School Facilities

Identifying shortcomings of the current schools models is one of the main objectives of this study. The intention here is to review the general results and perceptions obtained from the literature about the current schools facilities. The review started from the universal picture of developing school facilities and ended by specific shortcomings within the context of Saudi Arabia.

Tanner (1999) believes that the main problem today architects fail in is trying to accommodate 21st century paradigm in 19th century architecture. Nair and Fielding (2005) summarized the contradiction between the development in both educational and school facility by saying that: most school architecture tended to look at spaces in a linear way. This means that the function of the space is decided first, and then the design of that space is conducted to accommodate that particular function. Over the last 60 years, the result of such practice was rigid buildings that either arrange classrooms along horizontal circulation routes or design classrooms around an open multi-purpose space (Lippman, 2004). In the last situation, as it is more relevant to the practice in Saudi Arabia, in addition to the opaque nature of the space, the design approach provided the opportunity

for competing tasks and opposing motivations by individuals within the setting that might disrupt the differing goal-directed activities (Lippman, 2004). Also, it splits the basic human needs of its occupants in an artificial way that has a negative emotional and psychological impact on the people who use them (Education Foundation, 2002).

The final result was static spaces (or enclosed system) that ignored the complexity of human experience and the facts obtained from researches on mind and how people learn. David Pesanelli (1999) ascribed this approach to the tendency of architects and designers to be objects oriented rather than process oriented. Due to the 'lifeless' exclusive quantitative facility program (so many square meters, so many tables, so many storage units, etc) provided to the architect, the main principle which remained for the architect was to design a beautiful object, and if it costs much, it is enough to be an economical object.

In addition to the general limitation of the conventional school mode, the following are some of the main shortcomings of school facilities within the context of Saudi Arabia.

- There is misunderstanding about the idea of providing educational opportunities. The general perception about providing opportunities linkage to the capacity of the educational system –or in more particular the school facility –to accommodate more students in term of providing more space (seats) for them. This perception deals with learners as numbers and neglects the differences between individuals. This is justified by emphasis on the expression "equity". The way educational opportunity or equity should be perceived is providing all the means that would ensure that all learners obtain similar chance to succeed. It means each student learns what he needs in the way that suits him based in his capablities (Nair, 2006, *Shahata*, 2004)

- In all the reviewed studies that addressed the adequacy of school buildings, there is an agreement that school facilities are tend to be behind the educational requirements. This has been mainly traced to the separate

manner in which education and schools are developed. (*Al-Silliman*, 1981, *Sarhan*, 1986, *Khafaji*, 1987,)

- School buildings tended to be always short of resources, equipments and furniture. Remarkable shortages of ICT resources have been common. (*Al-Silliman*, 1981, *Al-Mubaraz*, 1999, *Al-Zemami*, 2000, *Al-Soufi*, 2001)

- The current models of the school are rigid and resistive to change, which limit the capability of the facility to grow and accommodate the evolving needs of education. This was mainly traced to the way design is approached. The current practice design school based on the academic curriculum. In most cases, the curriculum is rigid and designed to meet certain objectives. Also, curriculum is subjected to change as educational objectives and outcomes change (*Gumber*, 2006, Nair, 2006)

- The design of the school facilities give too emphasis on the formal education that is directly related to the academic curriculum. Students in school learn more than just facts and numbers; they also develop skills for life. The "hidden curriculum" where students learn from peers, the environment, communication and media source and informal learning should be given equal importance. ( *Al-Ageal*, 2007, *Al-Turki*, 2007)

## 2.2 The Inevitability of Change: Influential Factors Related to Educational Practice

School facility is a reflection of an adopted educational philosophy (Sanoff, 1981). Educational philosophy is a synthesis of purposes, process and ideals about education (Wikipedia). It also concerns human development (as individuals) and the relation between education and society (Britannica). There are many aspects that influence the way ideas and philosophies about education are shaped, and consequently the overall adapted educational system intended to achieve them. These aspects are strongly related to the characteristics of its era such as social aspect, economical aspects, political aspects and the development in various disciplines of knowledge. For better visualization of the required education, it is necessary to cast the light on the characteristics of the era and the factors that would influence the type of education.

### 2.2.1 Study of The Mind and Learning Theories

John Bransford (2000) in his inspiring book "How People Learn: Brain, Mind, Experience and School", mentioned that the revolution in the study of the mind resulted a new theory of learning leads to very different approaches to the design of curriculum, teaching, and assessment than those often found in schools today. How people learn and the studies of mind are always considered as one of the main generator of pedagogy theories which affect the way we are looking and designing the education system and consequently, how we design the physical environment that supports learning.

A common definition of education (Illeris, 2000; Ormorod, 1995) is a process that brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views. Explanations of what is happing in the learning process constitute learning theories (Wikipedia). There are three main frameworks under which learning theories

fall: behaviorism, cognitivism, and constructivism. Behaviorism was discussed under old perception of education. The other two types are discussed in the following.

#### 2.2.1.1 The Cognitive Theories

The cognitivism theory replaced behaviorism in 1960s as the dominant paradigm. Gestalt psychologists criticized behaviorists for being too dependent on overt behavior to explain learning. Gestalt proposed looking at the patterns rather than isolated events. Cognitivism focuses on the inner mental activities of the human mind which is considered necessary for understanding how people learn. Mental processes –such as thinking, memory, knowing, and problem solving –need to be explored. In contrast to behaviorism, people are not "programmed animals" that merely respond to environmental stimuli; people are rational beings that require active participation in order to learn, and whose actions are a result of thinking. Changes in behavior are observed, but only as an indication of what is occurring in the learner's head. Cognitivism uses the metaphor of the mind as computer: information comes in, is being processed, and leads to certain outcomes. Aspects of cognitivism can be found in learning how to learn, social roles, intelligence, and memory as related to age. (LTK, 2009, Wikipedia)

#### 2.2.1.2 The Constructivism Theories

More recently, the Constructivism approach has been favored as an explanation for how people learn in more complex environments where deep learning is sought. Jean Piaget's (1896-1980) theory of constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements.

The attention of the approach is on the kind of learning experience and the ability to extend what has been learned in one context to new contexts (Byrnes, 1996). The

ultimate goal of educators is that students will transfer learning from one problem to another within a course, from one year in school to another, between school and home, and from school to workplace. The process in which learning occurs depends on the accommodation of new information into existing frameworks that the learner has established for fitting pieces of information together. At times, new frameworks must be constructed as well (WBC, 2006).

Although constructivism is not a particular pedagogy, it is often associated with pedagogic approaches that promote active learning, or learning by doing, which best fit with learner-centered learning. Other discoveries about the human brain also emphasize the strong connection that learning has with emotion and individuality. (WBC, 2006)

Within the constructivism theories, the role of the teacher is very different than the tradition practice of teaching. The teacher here is a facilitator for constructing knowledge rather than an instructor who provides knowledge. As a result, the teacher should never tell students anything directly but, instead, should always allow them to construct knowledge for themselves. (LTK, 2009)

#### 2.2.1.3 Other Learning Theories: The Multiple Intelligent Theory (MI)

Dr. Howard Gardner, director of Harvard's Project Zero, has developed one of the most prominent discoveries, the "Multiple Intelligent" theory (MI). Based on (MI) theory, all kids are smart, but they are smart in different ways. All children have potential (Hoerr, Thomas R, 2000). Being smart is no longer determined by a score on a test, being smart is determined by how well students learn in a variety of ways. Dr. Gardner identified eight different "intelligences" that help to define how individual learners receive and processes information. These intelligences are: (1) verbal/linguistic, (2) mathematical/logical, (3) visual/spatial, (4) kinesthetic, (5) musical, (6) interpersonal, (7) intrapersonal, and (8) naturalistic intelligence. As Steven Bingler cited in his article "The Next Wave: New Learning Environments" (2003);

> *"Perhaps the most important outcome of Dr. Gardner's work has been to challenge the previously held practice that focused educational delivery systems almost exclusively on verbal/linguistic and mathematical/logical learning."*

Given the attention to the student's background while he attends the class and the potential intelligences he has, a question is raised about what happens in conventional classrooms where all the students in the class are handled as one mass. Through MI, schools and classrooms become settings in which a variety of skills and abilities can be used to learn and solve problems.

In addition to the "cognitive approach", "Constructivism approach" and 'MI' theory, at the level of classrooms and schools, Bransford, John adopted Brown and Campione (1994), and Cobb et al. (1992) proposition that considers learning as enhanced by social norms that value the search for understanding and allow students and teachers the freedom to make mistakes in order to learn.

### 2.2.2 Religious Demand: Islam Request for Searching Knowledge

In contrast to what may be thought about Islam –due to incomprehensive knowledge about it – seeking knowledge and running reflection about the universe is a well established concept in Islamic religion. The "*Holy Koran*" and "*Prophet Muhammad Sunna*" are the two main sources of *Islamic Sharia*. The both sources request all Muslims –man and women – to apply the scientific approach in their mission toward obtaining knowledge. The first word mentioned in the *Koran* is "*Iqra*", which means read. Also, the request to reflect the universe is mentioned in 24 positions in the *Koran* (*Intonation Koran, 2008).* This is in addition to the inimitability of the *Holy Koran* in many scientific aspects (*El-Naggar, Z,* 2008, and others).

The *Sunna* is full of Prophet's Sayings that encourage Muslims to learn and search for knowledge. This could be traced in the *Sunna* through its emphasis of three merits related to learning and knowledge (*Al-Imam Al-Gazali,* 1058-1111AD*)*. (1) The merit of knowledge in its self. In this regard the Prophet said: "scientists are inheritors of prophets…". (2) The merit of learning (searching for knowledge). In this regard the Prophet said: "Search for knowledge is a duty for each Muslim". (3) The merit of teaching others. In this regard biography books of Prophet Muhammad mentioned that the Prophet preferred to set with people who teaching others rather than setting with the people who only invoke the God.

In addition to the clear appreciation of the knowledge in the Islam, Islam has requested the Muslim to prosper the earth, and considered this as one of his main duties during his entire life. In this regard the prophet said: "If doomsday comes and if you were had a seedling, if you can plant it before you stand, do it".

### 2.2.3 Economic Changes

Education is directly related to the economic development as the required human resources for the world of business are often the outcomes of the educational system. During the industrial revolution, the dominant feature of the economy was manufacturing-oriented. Then, the economy changed into the information age. Now, creativity is the currency of today business. Creative economy means it is not enough to have a lot of knowledge and technical skills to guarantee a job, you have to be distinguished in some area to obtain that job (Coppen, Murray, 2001, and DESIGN/builder magazine). Bob Lutz, the vice chairman of General Motors (GM), explains this meaning by saying: "What we've got at GM now is a general comprehension that you can't run this business by the left, intellectual, analytical side of the brain. You have to have a lot of right side, creative input. We are in the arts and entertainment business, and we're putting a huge emphasis on world-class design." (Bingler, Stevend,

2003). Nurturing creativity in school should start from the acceptance that not all students will learn the same things in the same way in the same time (*Zaher*, 1999).

The "National Strategic Economic Plan" of Saudi Arabia was developed in 2004. It aims to achieve the imperious national economic objectives which necessitates overcoming many challenges facing the Kingdom including (*Ministry of Economic and Planning, KSA*): (1) Improving life quality of citizens, (2) achieving the continuance development, (3) fostering economic competition capability as a result of globalization, and (4) achieving the Arabic and regional economic partnership. The foundation to overcome these challenges is to achieve the connection between the human resources and the requirements of the development (*MTAGC*, 2001, and *MEP*, 2004). To a large extend, the educational system has great responsibility to provide the basic requirements of the needed human resources. In this regard, the "National Strategic Economic Plan" indicated two things: (1) the demands of the economic development have surpassed the available local human resources. (2) There is a weakness in the matching of the outcomes of the educational system and training programs and the demands of the economic development.

### 2.2.4 Cultural and Social Changes

As a result of the wide separate of cultural institutions in recent years, the Saudi society has witnessed dramatic cultural changes (*Al-Hamed and Others*, 2002). These changes involved all ideological aspects either tangible or moral such as values, habits, traditions, and knowledge. Some of these changes are (*Al-Hamed and Others*, 2002):

- Changes in youth values
- Changes in women's situations, where they have became more active party in the national development

- Changes in the pattern of relations inside the family. For example; it has been change from extended family to small family.

- Changes in the pattern of relation in the community. As a results of the influence of the existing various nationalities in the Saudi community.

- Widespread communication and media

- Reduction of the percentage of illiteracy in the society.

On the other hand, researchers believe that it is not possible to separate social changes from cultural changes. This means that any change in social system or social relation patterns is a consequence of changes in value, beliefs, traditions, etc which are considered as cultural changes.

However, the social changes have influenced the perception and expectation with regard to education. At a time in Saudi Arabia before 30 years ago, graduation from an intermediate school was almost equivalent to obtaining a bachelor degree in today's standard. Pre-school learning –which was considered as luxurious prestige limited to a certain class of society who could afford to pay its cost –becames a general demand sought by many levels within society (*Tunkaji, Emad*, 1989). The societies in general, used to consider school deserves excellence in education if 2% of its students obtain outstanding result while 80% of the students are around average while 50% of urban high schools drop out (Nair, 2005). Today, more parents are expecting their kids will succeed, and they left a heavy load in school to provide their kids with more skills that will prepare them to get superior job and be a responsible citizen. The solution for many parents is to send their children to private schools instead of public schools (*Al-Rsheed M*, 1996). Such direction should force public schools to work for all of its clients (the students) instead of spending too much to get very few (*Zaher*, 1999). Parents should have the right to decide the best for their adolescents, and various options must be made ready for their decisions.

### 2.2.5 Political Changes

About the political decision, regardless how it is utilized, there is a serious conation in politics stronger than ever before to improve the whole education system in a way that guarantees a better future for their citizens and their countries. This desire is reflected in the outstanding budget dedicated for education. In United States, the approved educational budget for the year 2008 is $56.0 billion which is considered as one of the highest budget dedicated for education along the education history of America (USDE, 2008). In England, they are working in an inspiring project that aims - within fifteen years- to rebuild or remodel all High-schools in England to meet the needs of the challenging future. € 2 billion is dedicated annually to achieve the purpose of this project (UKDES, 2007).

Considering Saudi Arabia, the total educational budget (including high education) for the year 2007 represented 24.18% ($25.79 billion) of the total national budget. Moreover, the latest educational budget for the year 2008 promises to build 2000 new schools and rehabilitates another 2000 schools all around the kingdom (MOE, 2007).

On the other hand, the Kingdom has experienced recently new movement toward democracy. This is reflecting in the wide delegations given to the *Shoura Council* (State Consultative Council). In addition, public elections have been initiated to select number of executives for various positions within several public organizations. These new political directions require a different culture and practice of the society than what was available before.

### 2.2.6 Technology Revolution

Nothing is more clear than the potential benefits technology can provide to the learning process. If we continue to make the advances in the use of technology in education in the next 50 years that we have made in just the past 10 years, one can only

begin to imagine what possibilities lay ahead (Thornburg, 1998). Technology in school is not a matter of hardware and software available in the IT laboratories or –in better condition –few computers distributed within the classroom. Technology must be integrated into school and curriculum. Laptop computers, wireless Internet access, videoconferencing, interactive whiteboards, and a range of other technology tools have the capability to transfer the learning environment; school-teacher-parent communication; and even the basic functioning of the school buildings security, heating and cooling systems, and lighting (NSSD, 2005)

In response to the great impact of IT in education, a promising project called *King Abdullah Project for Developing Public Education (Tatweer)* was introduced. The project aims to effectively integrate the use of IT in the education process (*Tatweer*). Although the project secured 9 SR billions, it has been planned to be implemented in the existing school models.

### 2.2.7 The Impact of Physical Environment on Education

The physical environment in which the education process takes place is an important area that needs further discussion about it is the impact on education. For many students and even some teachers, the condition of the school building is the most sensible measure that reflects the type of education they are involved with. Although the negative image of the physical environment conveys an unfavorable message about the quality of education that taken place at that environment, there is no explicit relationship between the physical environment and educational outcomes, which has led the educational community, policy makers and the public –at large –to perceive school facility as a passive shell which contains what is more important; teaching and learning (Jeffery 1994). As Jeffery believed, this was due to the lack of theoretical models and empirical research that link the physical environment to educational process.

Along school history, the physical environment as reviewed by many researchers has been kept to satisfy minimum standards with basic issues related to the actual condition of the school facility and some of the environmental aspects of the physical environment. Building age, indoor air quality, ventilation, acoustics, lighting, thermal comfort and class size are considered as the most important elements that have been investigated. The 1960s witnessed the early attention about the school physical environment and how it is related to students and teachers performances. Research from different fields including educational psychological, environmental psychological and environmental design formed the nucleus of that effort (Jeffery 1994).

### 2.2.7.1 The Debate of School and Class Sizes

Two of the greatest variables of physical environment with an established an agreement about their impacts on academic achievement are school size and classroom size–or the ratio between teacher and number of students in the class. Gary Moore (1995) stated in his article "Design Patterns for American schools: Responding to Reform Movement" between the early 1960s and 1980, 344 articles were published pertaining to the effect of school size on academic and other achievement-related variables. He mentioned a study conducted by Roger Barker and Paul Gump in 1964 where comparing between very big high schools with 2000 students and very small high schools containing 100 to 150 students. The study showed that small schools offered students greater opportunities to participate in extracurricular activities, to exercise leadership roles, and to join social organizations. Small schools (less than 500 students) demonstrated lower incidence of crime and less student misconduct, increased sense of responsibility and more willing participation. From the teachers' side, it enhanced teacher interaction, improved classroom management, provided more opportunities to reduce teachers' stress, and enhanced teacher creativity to adapt more innovative teaching techniques (Jeffery 1994).

Although Mark Schneider (2002) stated that while there is a consensus about the positive effect of small school size, the classroom size debate is unresolved. On the other hand, William Fowler (1992) and Jeffery Lakeny (1994) through their literatures review regarding classroom size (or classroom density) they indicated that as class size decreases, students' achievements increase. Fowler (1992) summarized the literature on class size and concluded that small classrooms (20 students or fewer) have the potential to enhance students' attitudes, voluntary participations, and achievements. Jeffery (1994) concluded the review by mentioning that reducing class size from 30 to 20 students can yield an improvement of 6 percent on achievement scores, where as a reduction from 20 to 10 students per class can improve achievement by 13 percent.

### 2.2.7.2 Environmental Control Aspects

Environmental control aspects –called elements of high performance –such as indoor air quality, ventilation, thermal comfort, lighting, and acoustic have been the focus of many recent studies. One of the most recent and comprehensive work addressing these issues is "Green School: Attributes for health and learning" prepared by the Board on Infrastructure and the Constructed Environment (BICE, US), and the Engineering and Physical Sciences (DEPS). The book ensures that the concept of green school has the potential to support students and teachers' health, learning, and productivities. In more details about light variables, Heschong Mahone Group (1999) investigated the affect of window size and amount of day light on the performance of students, the study showed that students with more daylight progressed 20% faster on math and 26% on reading tests in one year. And those with greater window area progresses 15% faster and 23% faster in reading than those with least window area. Combining the effect of light and color, Grandaard (1995) compared the impact of white walls and cool-white fluorescent light with blue walls and full-spectrum lighting on the students' behavior. Off-task behavior and mean blood pressure were measured for 6-year old boys and girls in public school before, during and after modification. A decrease of 22% in off-task behavior was observed in the room with blue walls and full-spectrum lighting and mean blood pressure was 9% lower.

### 2.2.7.3 Open Plan Schools

Going back to the history of school facilities, the mid of 1960s experienced the tendency toward open education which translated architecturally through the open plan of school facilities. Regardless whether the transformation was successful or not, many scientific and empirical researches documented that open education or open space school led to increased interaction among teachers, greater sense of autonomy, satisfaction, and ambition. From the students' side, it enhances students' participation, feeling of

autonomy, willingness to take risks, and increases the opportunities of interaction between students and teachers (Jeffery 1994).

#### 2.2.7.4 Teachers' Performance

In addition to the studies that addressed specific aspects of physical environment, many studies have been conducted that link the physical environment of school facility as whole to the students and teachers performance. In a study involving 47 small, rural high schools in Virginia, students' achievements were positively correlated with a better physical environment (Cash 1993). The 21st Century School Fund (USA) in its guide to renewing public school building ensure that physical environment of school facility is a major factor that affecting teacher's performance, and it is one of the main cause for teachers' attrition. In a study that involved a large sample of teachers in Chicago and Washington, D.C., Mark Schneider (2003) supported this fact and many other issues related to the impact of school facility conditions on teachers' performance. Teachers in the assessed schools were asked to rate the working conditions in their schools and how they perceive these conditions affecting their job performance and teaching effectiveness. Issues of evaluating included: degree of overcrowding, availability and adequacy of specialized facilities as science labs and physiological factors, including indoor air quality, thermal comfort, classroom lighting, and noise level. The study concluded that school facilities have direct affect on teaching and learning. Poor school conditions make it more difficult for teachers to deliver an adequate education to their students, adversely affect teachers' health, and increase the likelihood that teacher will leave their school and teaching profession.

### 2.2.7.5 Students' Performance

In a similar study conducted by Mark Schneider 2002 on the affect of school facilities on students' academic outcome, Schneider concluded by saying that: while there is a consensus about the positive effect of small school size, the classroom size debate is unresolved. Generally, it is safe to say that school facilities affecting learning. Spatial configuration, noise, heat, cold, light, and air quality obviously affect students' ability to perform. Empirical studies will continue fine-tuning these variables until they reach optimal academic outcomes. Prior to the work of Schneider, Maureen Berner (1991) tried to investigate to what extend the physical environment may affect academic achievement. Berner used Washington, D.C. as a case study to examine the relationship between parental involvement and school building conditions and between building condition and student achievement. Regarding the affect of building condition on students' achievement he classified school into three categories; poor, fair, or excellent. The result he obtained is that an improvement in physical condition by one category was associated with a 5.5 point improvement in average academic achievement score on standardized tests. So, if schools' condition were to move from poor to excellent, it could be predict that an increase of approximately 11 points in the schools' average achievement scores.

### 2.2.7.6 The Physical Environment as a Learning Tool

Farther beyond the direct or indirect impact of the physical environment on teachers/students' performance, Henry Sanoff (2001) identifies the physical environment as the second teacher since space has the power to organize and promote pleasant relationships between people of different ages, to provide changes, to promote choice and activities, and for its potential for sparking different types of social, cognitive, and affective learning. This concept is supported by many researchers who insisted that teachers should be aware about the potentials of the physical environment so that the building could be utilize as open textbooks (Ashraf Salama 2005).

### 2.2.7.7 Educators and the Physical Environment of School

From the viewpoint of educators who work in teaching on a daily basis, Jeffery Lakeny (1994) in his review about the impact of the physical environment on education mentioned that educators expressed their acceptance about that the physical setting of schools has an effect on the teaching and learning which takes place within their schools. Also, Paul Goldberager's (1990) review of the design competition in New School for New York concluded, "Educators begun to suggest that the real sin in contemporary school design is size – the winning school is … smaller."

### 2.2.8 New Directions of Education: Evolving Educational Paradigm

As it was discussed in this chapter, there are many factors influencing the form of the required education. As the changes associated with these factors are dramatic and different than what were ever before, the type of education required to overcome the emerging challenges should be different than what was before (*Zaher*, 1999). Many educators and schooling concerned researchers insist that we should not provide 21st century's children the "traditional education" that based on depositing facts and memorization (*Shahata*, 2003). The type of the education should provide children the essentials demanded by the new century. This has evoked many thinkers and researchers (such as *Khaled Al-Awad* 1998, Deiaa Zaher, 1999, *Al-Hamed and Others*, 2002, Jeffery Lackney, 2003, Prakash Nair, 2003, *Hassan Shahata*, 2003, and Stevenson Kenneth, 2002, 2007) to write about an evolving educational paradigm that has different characteristics than what was dominant in the past. The evolving paradigm is directed more toward hand on experience and real practice. In addition it aims to achieve balance between the epistemic goals and the sentimental goals of the learners. The psychological aspects of the learner and the ability to excite his desire for learning to the farthest extend are also another concern in the evolving paradigm. It also emphasizes learning activities that educators are expecting to last more in the future, such as collaborative learning, small group project-based learning, one-to-one learning, peer tutoring and individualized learning (Jeffery, 2001). This would change the day of student in the school as Skill and Young (2002, p24) stated: "… learners should spend one-third of their day at the computer, one-third of their day talking with others, and one-third of their day making something…". Thus, fragmented periods of time each of 45 minutes, with 5 minutes in between are less expected to fulfill the requirement of the evolving paradigm. Instead, a block scheduling is more responsive to these requirements (Moore & Lackney, 1995).

In general, it can be said that there is a transition from teacher-centered learning to learner-centered learning, or in other words; from a "conventional paradigm" which relies

on memorization, to a "constructive paradigm" which relies on understanding (Brown, 2008). ***Table 2.2*** summarizes some of the main difference between the two paradigms.

***Table 2.2*** *Differences between Educational Paradigms: Conventional and Constructive (source: Brown, 2008)*

| **Traditional Paradigm "Teaching"** | **Constructivist Paradigm "Learning"** |
|---|---|
| *Memorization* | *Understanding* |
| *Recall* | *Discovery* |
| *One size fits all* | *Tailored; option rich* |
| *Talent via weeding out* | *Talent cultivated and sought out* |
| *Repetition* | *Transfer and construction* |
| *Acquisition of facts* | *Facts + conceptual framework* |
| *Isolated facts* | *Organized conceptual schemas* |
| *Transmission* | *Construction* |
| *Teacher = master and commander* | *Teacher = expert and mentor* |
| *Fixed roles* | *Mobile roles* |
| *Fixed classrooms* | *Mobile, convertible classrooms* |
| *Single location* | *Plurality of locations and space types* |
| *Summative assessment* | *Summative and formative assessment* |

Michael DeArmond, Sara Taggart, and Paul Hill (2002) in their research about the future of school facilities grouped the change in educational trends into five main trends; each has its own implications on school facilities that may overlap in some cases. The five tends are:

- Pressure on schools to perform for all students, not just those who learn best in tradition settings
- Demands for the personalization of learning, so that every student has a chance to learn and families have choices
- New technologies that will change how teachers teach and how students learn
- Periodic shortages of qualified teachers (and school leaders) linked to swings in the economy
- Shifts in students' population and residency patterns that will affect not only the demand for schools, but also the demands on schools.

All the elements discussed above and others as well, exert a tremendous pressure to cope with the requirements of the new directions of learning and education. How we respond to change determines whether the change is positive. Given the inevitability of change, it is incumbent that we be as proactive as possible and anticipating how it affects us (Hoerr, Thomas, 2000).

### 2.2.8.1 Future Direction of Education in Saudi Arabia

As discussed above there is overlap between the universal and the local directions of education. These common concerns are clearly noticed especially when discussing academic development in particular. This overlap is expected as we are living in the globalization era, where many of the desired academic characteristics are common (*Zaher*, 1999, *Shahata*, 2003, *Al-Turki*, 2007). In addition, education by its norm, carries with it innovation, new ideas, and new values, which belong to humanity's contributions all around the world. But, this does not eliminate the need to induce change from within for two main reasons. First; each society will still have its own identity and distinguished needs (*Gamber*, 2006). Second; for changes to be accepted, they should be conformed to the cultural norm of the society (*Al-Soliman*, 1981, *Al-Awad*, 1998). The following is a range of concepts, ideas and visualizations founded in the local literature that would render the future directions of education in Saudi Arabia (*Al-Hegial*, 1989, *Al-Rasheed*, 1996, *Al-Awad*, 1998, *Al-Hamed and Others*, 2002).

- Preserve cultural identity while accommodating internalization demands.
- Adapt strategic planning as a means for developing education.
- Consolidate community participation in the process of facing educational problems.
- Balancing between the developments of individuals, social and economical.
- Emphasize the comprehensive development of the individuals.
- Give more attention to the quality of education based on individual differences.

- Transfer from teacher-centered approach to learner-centered approach.

- Emphasize innovation and creativity in education, which require reforming curriculum, courses' contents, teaching/learning strategies, effective use of technology, and teachers' training.

- Emphasize independent learning rather than dependent one.

- Emphasize continuing education.

- Develop the role of teachers in the learning process.

#### 2.2.8.2 The Impact of the New Directions on the School Facilities

Within the local and regional domain, in contrast to the well established research regarding educational aspects (such as educational difficulties, directions, teaching/learning strategies…atc), there is a shortage in the research regarding the new directions of the physical environment of the school facilities. Within the context of Saudi Arabia, this could be traced to three main reasons. (1) The perception about the impact of the physical environment in Education. The common perception is that school –as a building –compasses what is more important. So that as long as certain elements are maintained, it is enough to consider the required physical environment have been met. (2) The predetermined image about school facilities. So that it has become censured taboo to think out-side of the box. (3) The heavy heritage of the rented school which has made the main concern is to replace them by normal public school facilities.

Within the universal domain, there is more efforts could be found regarding the new directions of school facilities that aim to be in parallel to the development in educational directions. These efforts have increased, but needs more theoretical framework which will enable further and more mature development in the actual practice

of designing school facilities (Jeffery, 1998). Also, it needs to be tightly related to the well established educational concepts.

From the review conducted in this chapter about the impact of the physical environment on education it could be concluded that there is a strong agreement about the impact of the physical environment on teachers and students' behavior and attitudes, and an expected consensus about the direct effect of the physical environment on academic performance. Beyond the direct and the indirect effect of the physical environment, students and teachers –as Donald Moore of "Design of Change" believed –deserve a decent school environment for its own seek, since schools are not only institution intended to achieve certain outcomes, but also small communities in which pupils and adults spend a substantial portion of their lives (Moore 1991). The physical environment is a main pillar that deserves an equal attention to other strategies pertaining to improve the academic outcomes in any serious work to reform the educational system. Thus, should school facilities continue to be held to minimum standards, or should more effort be done to continually optimize the role of the physical environment in educational process?

How the design of school facility responds to the paradigmatic shift in education will depends on what, why and how we are designing for (Jeffery, 2001) (Tanner, 1999). As announced by the American Architectural Foundation (2006), "The design community must respond more quickly to the ongoing changes in teaching and learning; … Design process should give voice to multiple ways of learning in multiple environments; … The voice of design is needed in this larger conversation about schooling and education. This would require a new model used to design educational environments (Lippman, 2004) which should emerg from the **learning activities** pertaining to achieve the intended educational goals, rather than purely economical consideration like maximizing space and minimizing cost (Tanner, 1999) (Anstrand & Kirkbride, 2002) (Stevenson, 2006) (Brown, 2008) (Nair interview). This vision would require the dialogue change from building design to learning and education (Nair, 2006), where the educator and architect, assisted by community influence, work together (Tanner, 1999) (Jeffery, 2001). The

schools that came out of that process actually looked quite different from the schools that would normally come out of people's perception of what a school building is supposed to look like (Nair, 2006). If the future is such that for each 20 to 25 students there will be a professional teacher housed in a traditional classroom, schools will look very similar to what we see today (Stevenson, 2006).

The National Summit on School Design, USA (NSSD, 2005) illustrated the bold lines relating to the planning and design of future school facilities by emphasizing eight recommendations for school design excellence:

- Design schools to support variety of learning styles,
- Enhance learning by integrating technology,
- Foster a small school culture,
- Support neighborhood school,
- Create school as center of community,
- Engage the public in the planning process,
- Make healthy, comfortable, and flexible learning environment, and finally
- Consider non-traditional options for school facilities and classrooms.

# CHAPTER 3

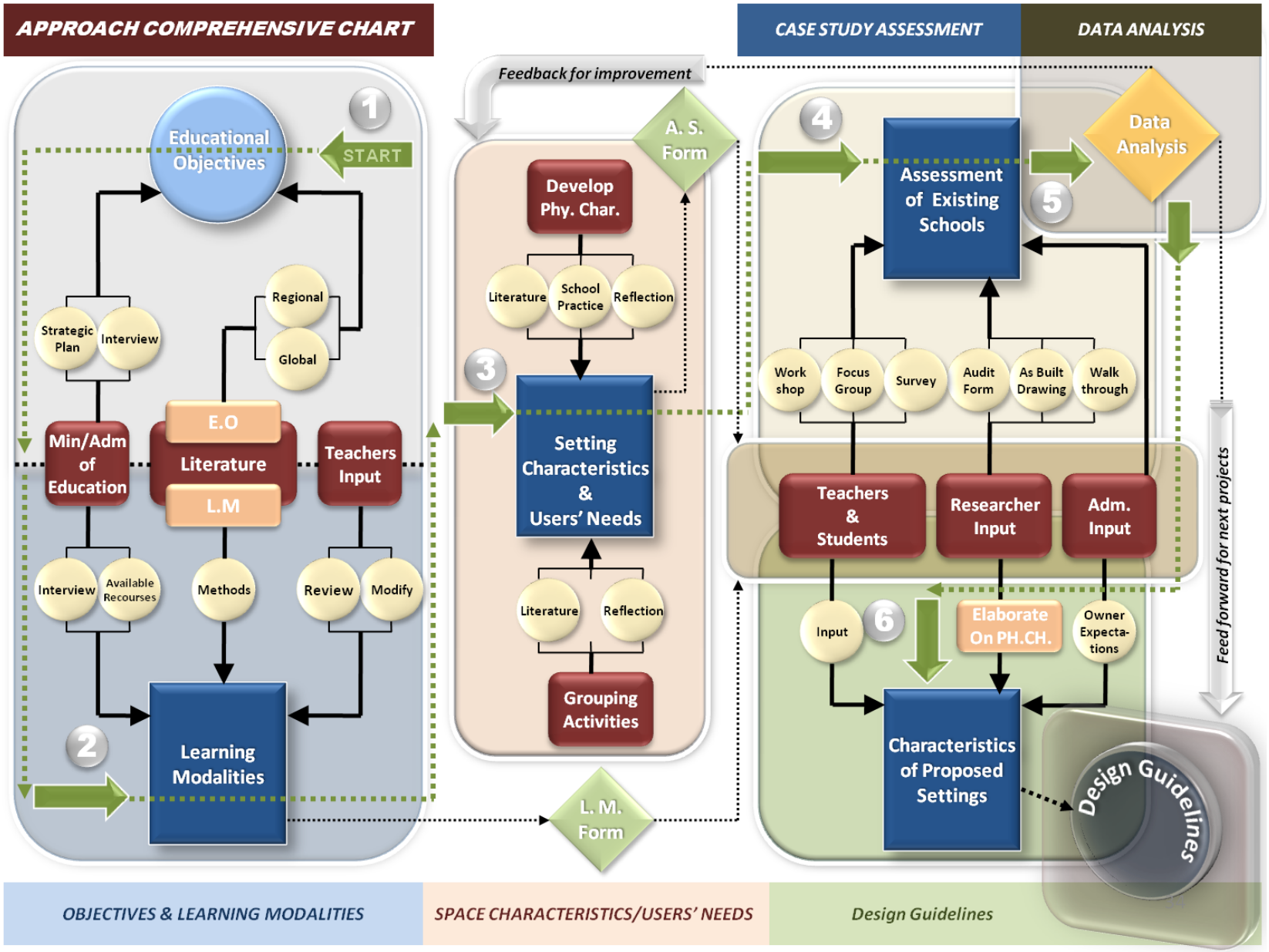
## AN APPROACH TOWARD RESPONSIVE SCHOOL FACILITIES: LEARNING ACTIVITIES AND ACTIVITY SETTINGS

### 3.1 Background

This chapter is intended to achieve the first objective of the study by answering the raised question; "What are the activity settings public high-school should have in order to accommodate the new educational directions? And how these activity settings can be developed?"

Answering this question goes to the heart of this thesis which required to develop an approach that has the potential to effectively translate the educational requirements into a responsive physical environment. According to the research methodology, the approach can be divided into three main parts. Part one pertaining to identifying the activity settings (discussed in this chapter). Part two pertaining to conducting the case study and benefit from it to enhance the activity settings (discussed in chapter four). Part three pertaining to develop design guidelines for the activity settings (discussed in chapter five). The overall process of the approach is illustrated in figure 3.1.

***Figure 3.1**: Overview of the Developed Approach*



The discussion in the two previous chapters showed that the conventional school models come up against the evolving educational requirements and user needs. The conclusion reached has ensured that there is a need for a new school model developed in line with educational requirements. Although a new model of school facilities have started up, they are in the beginning and need further elaboration on the basic "alphabet" that composes the overall physical environment of the school.

In the conventional model, school is organized based on rigid curriculum which is subject to change. In contrast, the evolving model should be able to accommodate various activities occurring within various activity settings that are designed as flexible and integrated systems (Lippman, October 2002). Thus, identifying learning activities and their corresponding activity settings in which these activities are best practiced is a key toward designing a responsive school facility for the evolving educational paradigm. Lackney Jeffery (2001) indicated this by considering that focusing on the activities of learning instead the components of the program is the first in seeing the new paradigm. He also emphasized that, it is important to solve the whole problem not focusing on aspects we are most familiar with and try to solve them (Jeffery, 2001).

For the purpose of this thesis, different teaching and learning strategies, methods and approaches (Learning Modalities) would be identified in light of educational objectives. For each Modality, the indented objectives and the required activities needed to be achieved would be identified. A variety of activities and learning relationships suggest multiple types of learning spaces which would lead to the development of the intended activity settings.

## 3.2 Identifying Activity Settings for High-Schools

The scope of the study is related to the educational requirements with more emphasis on academic objectives. The aim of the identified activity settings is to facilitate the associated activities pertaining to educational/academic objectives, and satisfy user

needs emerging from conducting these activities within physical settings. Thus, the first step would be identifying the desired educational/academic objectives and the activities pertaining to achieve them.

### 3.2.1 The Importance of Educational Goals/Objectives for Developing Learning Settings

The responsive educational environment is the one that can accommodate the educational goals and objectives for which education process is carried out in schools. Since the adapted educational goals are the incentive toward developing educational curriculum and teaching and learning strategies, it is necessary for the physical environment of education (the school building) to cope with this development in light of the intended goals. The school building –in its first threshold –is the spatial place pertaining to facilitate the accomplishment of the educational activities that take various means and patterns based on the demands raised from the intended objectives. Thus, it is important to consider the educational goals/objectives and the various means demanded to achieve them as the departure point toward designing the school building. However, in contrast to the enormous development in education, teaching and learning methods learning resources, the school building has stayed behind. If innovation and creativity are some of the main concepts educators call for, why should the school building always adherence to the conventional?

The belief in the educational goals and objectives and their influential role in education should be the incentive and the inspiration in designing school building. Thus, it is important to identify the minimum limit of the agreed on educational goals/objectives and the demanded teaching and learning strategies pertaining to achieve them. This would help in visualizing the features and characteristics of the school building that are capable to support them. However, because educational policy recently has become a part of the general policy of the state (*Al-Hamed and Others,* 2002), it is

important to identify the principles of the educational policy set to achieve the goals/objectives and the social ambitions within the context of Saudi Arabia.

- **Equity of educational opportunities**. Provide educational opportunities based on individual capabilities that would promise suitable jobs regardless of economic and social background.

- **Develop democratic behavior**. Ensure democracy as a social value and not only as a form of political administration. It is before anything a life style.

- **Promote of human rights**. Foster democracy, human dignity, freedom, equity and justice.

- **Develop a scientific mentality**. To make scientific approach and research the dominant approach for normal people before scientists.

- **Foster cultural identity**. Embodiment the characteristics and value of the national citizen, and the pride of its heritage.

- **Develop religious and ethical moderation.** Ensure religious and ethical restraint as an influential cultural aspect.

#### 3.2.1.1 Identifying Educational Objective

The process and the intentions of each conducted task were discussed under the research methodology. The final result of this phase is an enriched list of educational/academic objectives obtained from three main sources: (1) international literature, (2) regional literature with particular reference to Saudi Arabia, and (3) the strategic plan of the Ministry of Education.

The early native initiative to identify the aims of education could be found in the "Educational Policy Document in Saudi Arabia, 1970" (EPD, 1999). The document also stated the general objectives of each educational stage including Secondary Level. The following is the main general objective of High-School Level as stated in the document

- Strengthening the Islamic doctrine which gives the student a correct understanding of the universe, man and life on earth and in heaven and supplying the student with basic concepts and Islamic education which enables him/her to be proud of Islam and capable of preaching and defending it;

- Looking after the students' gifts and various capabilities which unfold at this stage and directing them appropriately thus achieving the objectives of Islamic education in its general sense;

- Developing the students scientific thinking and instilling in them the spirit of research, systematic analysis and the use of reference sources and the practice of sound academic methods;

- Opening opportunities to competent students and enabling them to continue their studies in higher institutes and universities of all specialties;

- Imparting in the students the best and useful reading habits and the desire to broaden their scope of knowledge and to use their leisure time in activities that improve their personality and the conditions of their community.

In 2004, as a result of the reform process of the educational system, new strategic plan of education was developed by the Ministry of education. The plan included more defined goals and objectives. The following tables (Tables 3.1, 3.2) show the general educational goals and the intended objectives that related to academic performance and the school facilities. (The complete list is provided in Appendix-A)

***Table 3.1:*** *General goals and objectives of the Educational Strategic Plan; Academic related (Source: Ministry of Education, 2004)*

| Goals | Objectives |
|---|---|
| • Improvement of internal and external sufficiency for the educational system. | 1. To reduce the failure rate to 5% in the elementary stage, 7% in the intermediate stage, and to 8% in the secondary stage.<br>2. To develop classroom patterns of learning and teaching (individual learning) to achieve better results according to student levels.<br>3. To reduce the drop-out rates to a general rate of 1% in all stages.<br>4. To diversify the standards of academic acquisition tests and their technologies.<br>5. To secure a safe school environment.<br>6. To improve the rates of success.<br>7. To improve the average number of teachers per student to that of 1 to 20 in the various educational fields by the end of the plan.<br>8. To improve the average number of administration employees per number of educational job occupants to a rate of 1 to 20.<br>9. To allocate financial resources conservatively in order to reduce rates of resource waste.<br>10. To improve the quality of male and female secondary education for university study.<br>11. To provide male and female students with the appropriate and necessary skills to enter the labor market.<br>12. To adopt a system of comprehensive quality in education. |
| • To develop syllabi based on Islamic values leading to the development of male and female students' personality and to their integration in society as well as to the achievement of scientific and thinking skills and life characteristics resulting in self education and lifelong learning. | 1. To develop syllabi that will ensure the development of the Muslim learner's personality to make him proud of his faith and to be loyal to his country in practice and conduct.<br>2. To develop syllabi in accordance to contemporary international trends according to the Islamic values.<br>3. To concentrate on students' acquisition of the skills of thinking, analysis, and communication.<br>4. The syllabi are to include new useful issues and to secure flexibility in dealing with the expected changes in knowledge and technology.<br>5. To provide students with the skills required for various social situations.<br>6. To develop self-education and life-long educational skills.<br>7. To provide students with the necessary skills to deal with advanced information and knowledge.<br>8. To activate the educational process through the employment of computer programs and education technologies and resources.<br>9. To increase the students' share in summer and non-summer activities to achieve practice at a rate of three hours per week.<br>10. To enable students to acquire the skills to invest their leisure time appropriately.<br>11. To provide male and female students with the required skills to practice their roles in forming a Muslim family. |

***Table 3.2:*** *General Goals and Objectives of the Educational Strategic Plan; Facility related (Source: Ministry of Education, 2004)*

| Goals | Objectives |
|---|---|
| • To develop the educational structure and to update the school map to meet the expected quantitative and qualitative changes in the next stage | 1. To replace the government's school buildings with modernly equipped ones at an annual rate of 10% for rented buildings.<br>2. To develop the school buildings' facilities in view of the vision and schools' future.<br>3. To secure and improve the required sources of education technologies in school buildings.<br>4. To increase sport facilities to allow students to get real practice of sport activities at an average of 8 meters per each student.<br>5. To increase male and female students' share in cultural, social, and scientific activities.<br>6. To link population movements and attitudes to the distribution of schools and buildings.<br>7. To secure efficient financial resources for school construction and renovation. |
| • To develop the infrastructure of information and communication technology and its employment in education and learning. | 1. To establish an integrated system for the application of information technology.<br>2. To establish an integrated system for the application of communication technology in education.<br>3. To enhance the integration between machine and human knowledge. |

Throughout the literature review (*Al-Hegail*, 1989, *Al-Hamed* and Other 2002), the general goals of education in Saudi Arabia could be categorized into seven main categories.

1. Objectives related to the spiritual aspects of the learner
2. Objectives related to the development of individuality and social behavior
3. Objectives related to citizenship and civilization
4. Objectives related to the preparation to higher education and work
5. Objectives related to the academic performance of the learner
6. Objectives related to use of IT in education
7. Objectives related to the healthy habits of the learner

In an effort to facilitate the translation of the educational/academic goals and objectives into a physical environment, the final list of objectives was further detailed. This would help investigating means pertaining to achieve them. As it is directly related to the teaching and learning, a list of academic objectives are presented in Table 3.3. Other objectives are provided in the appendix-B.

***Table 3.3:*** *Educational objectives: Academic objectives (one category out of seven)*

| | **Academic objectives** |
|---|---|
| 1 | Develop scientific mentality and the spirit of research and experimenting |
| 2 | Develop reading skills and perusal habits |
| 3 | Develop the skills of expressing and presenting ideas and solution (oral, written, graphical) |
| 4 | Emphasis learning rather than teaching |
| 5 | Develop criticism skills and the ability of logical convincing |
| 6 | Develop the "art" of obtaining data and information (ability to deal with vast amount of information) |
| 7 | Develop cognitive skills: identify problem and determine objectives |
| 8 | Develop data gathering skills: observation and forming questions |
| 9 | Develop memorization skills: develop symbols and recall them |
| 10 | Develop data organization skills: compression, assortment and arrangement |
| 11 | Develop analysis skill: de-compose, extract general ideas and identifying mistakes. |
| 12 | Develop production skills: prediction, conclusion and add details |
| 13 | Develop integration skills: summarizing and re-constructing knowledge |
| 14 | Develop assessment skills: develop measures and evaluating results |
| 15 | Develop individual learning skills and continuous learning |
| 16 | Stimulate creative thinking and in-conventional ideas |

### 3.2.2 Learning Modalities

The term "learning modalities" is used here to refer to the various teaching and learning strategies, methods and styles practiced by teachers and learners for the purposes of dissemination, delivering and acquisition of knowledge. The attention is to identify as much of the learning modalities that are expected to be demanded by current and future education. Equally important is to identify the associated activity within each learning modality. Because of that, educational objectives are experienced within the educational environment through the engagement of the all parties within the school (administrators, teachers, and students) in the activities that lead to the achievement of the objectives. In other words, if the objectives are to be considered as the central component of education, the learning activities are the sensible component of it.

#### 3.2.2.1 Teaching Strategies: Definition

There are many definitions and meaning of the term "teaching strategy" that could be found in the educational literature (*Zitoun*, 1999). A comprehensive definition of "teaching strategy" is provided by *Zitoun* (2003) is"

> *"The planned teaching and learning approach followed by the teacher in the classroom or outside it to learn specific educational content for the purpose of achieving predetermined objectives, the approach includes various procedures that are arranged in sequence, and conducted the teacher and the students".*

The teaching strategy aims to stimulate leaner interaction and motivation toward learning that would result is making the desired change in the behavior of the learner throughout the utilization of all available means and resources, including the physical environment (Mastropieri & Scruggs, 1994, Lovitt, 1995).

On the other hand, the educational literature emphasizes that there is no one ideal teaching strategy. This is because there is no one strategy suitable for: all academic subjects and courses, achieving all academic components, matching all teachers and students capabilities, and fitting within all physical settings (*Abdul-Hmeed*, 1999, and *Zitoun*, 2003). What could be said is that there is one or more strategies that are more suitable to teach specific topics, and achieving specific educational objectives, for certain types of teachers and students, if certain provisions to be available including the suitable physical setting(s) (*Zitoun*, 2003). This ensures that it is important to highlight the process of translating educational requirements into a physical setting because new teaching/learning strategies may be developed in the future.

#### 3.2.2.1.1 The Basic Components of the Teaching Strategy

Many studies ensured the importance of understanding the components of the teaching strategies by the teacher, and considered it as a main factor for the success of the educational process. Understanding the components will enable the teachers to efficiently select and implement the suitable strategy. The main components are highlighted in the following with more emphasis given later to the physical environment as it is the main subject of the study. ((Mastropieri & Scruggs, 1994, Lovitt, 1995, *Abu-Zainah*, 1996)

- The intended educational objective
- Teacher approach, style and employment of educational events and procedures
- The academic contents of the subject including examples, exercises, questions and educational means
- The overall learning environment and classroom management
- Students interaction; based on individual differences

- The Physical Environment

#### 3.2.2.1.2 Classification of Teaching Strategies

Three ways could be found in educational and pedagogy literature about the classification of teaching strategies (*Zitoun*, 2003, *Zitoun, K*. 1998). (1) Based on the effort exerted by the learner (student). It is either expository teaching strategy, which depend on direct explanation and instruction, or discovery teaching Strategies, which depend on the learner finding knowledge. (2) Based on the way learner obtains knowledge. It also can be divided either as direct teaching strategies by the teacher, or indirect teaching strategies where learner construct knowledge himself. (3) Based on the role of the teacher in the learning process. It either teacher centered teaching strategies, where the teacher has the main role, or non-teacher teaching strategies where the learner is the main actor. Between the two types in each category, different teaching strategies could be found that share features from two extremes approaches (active learner or passive learner) at different levels.

However, more common terms used recently to describe teaching strategies are teacher-centered learning (or approach) and learner-centered learning (or approach). The terms are used to refer to the two types of teaching strategies identified above under each classification. Teacher-centered learning in common tends to be direct instruction used to teach certain facts and basic skills. The teacher takes the responsibility of learning. As a result, the teacher is the one who provides the information, presents it, provides background about it, and ensures students assimilation of knowledge (*Shahatah*, 2003). The approach has been criticized as it compromising a number of distinct areas of understanding –science, mathematics, history, etc. all of which need to be taught and learned as distinct disciplines (*Khafaji*, 1987). Leaner-centered learning –on the other hands, has received more attention recently. The learning process here is more dependent on the student's activities as he become responsible on constructing the knowledge. The approach relies on that education that is not a one-way transaction between teacher and

students, but it is a co-operative enterprise in which students is encourages taking initiative, to explore his environment, to find things out for himself (*Khafaji*, 1987). The teacher provides the help needed to ensure that student gets the necessary skills and opportunities for developments –provides a scaffolding system (*Shahatah*, 2003). This approach tends to de-emphasis the virtual boundaries between subjects, they are more integrated (*Khafaji*, 1987).

#### 3.2.2.2 The Identified Learning Modalities

As discussed before, there is no limit for the teaching and learning modalities. However, the intention here is to identify the well establish strategies and the modalities that include activities expected to last in the future. Nair and Fledging (2005) in their book "*The Language of School Design*" identified 18 learning patterns school facilities in general should provide to enhance learning. As they believe, not every school will be capable to provide all theses modalities, but the more modalities supported by the school facility, the more responsive will be the learning environment of that school. These modalities include: (1) independent study, (2) peer tutoring, (3) team collaborative work, (4) one-on-on learning with teacher, (5) lecture format, (6) project-based learning, (7) technology-based learning with mobile computers, (8) distance learning, (9) research via the internet with wireless network, (10) presentation, (11) performance-based learning, (12) seminar-style instruction, (13) hands-on project –based learning, (14) naturalist learning, (15) social/emotional learning, (16) art-based learning, (17) story telling (floor seating, and finally (18) team teaching.

Within the local context, in 1999, the Ministry of Education introduced a project regarding developing teaching and learning strategies (GAEM). The project suggested starting with certain strategies that can be a base for further development in the future. The suggested strategies are: (1) collaborative learning, (2) brainstorming, (3) exploration learning, (4) role-playing, (5) constructive learning, (6) Diagnostic/Prescriptive Teaching, (7) communication, (8) critical thinking, (9) creative thinking.

For the purpose of this study, eighteen learning modalities were identified. The selection of the modalities was based on their potentials to achieve the intended education/academic objectives (identified before), and the ability to accommodate the new directions of education identified from the literature. Table 3.4 presents the eighteen identified Learning Modalities. It also presents the main educational/academic objectives that each modality is intended to achieve. A learning modality form (LMF) was developed for each identified modality. The LMF includes a brief description for the modality and the activities associated in conducting the modality. Table 3.5 is an example of LMF. The LMFs were developed so that they allow revision and modification by the Administration of Education in the Eastern Province and school teachers who would participate in the workshop (see Research Methodology).

Through identifying the objectives of each learning modality and the activities associated with it, and by comparing them to the general educational/academic objectives, the relationship between the learning modalities and the educational/academic objectives could be traced. Table 3.6 presents the potential match between the general objectives and the identified learning modalities.

(The detailed information and the involved activities of each modality "LMFs" are provided in the Appendix-C. the information obtained from many educational sources including: (*Zitoun*: 1999, 2003, *Zobidy, K*: 2003, *Zitoun, K*: 1998, *Abdul-Hameedm*: 1999, *Al-Hilah*: 2002, *Sager*: 2004, Owens and Wang: 1996, Haury and Rillero: 1994)

***Table 3.4:*** *The Identified Learning Modalities and their intended objectives*

| Learning Modality | Brief Definition | Educational/Academic Objectives |
|---|---|---|
| **1. Lecture (Collective teaching)** | Introducing a topic by the teacher, followed by introducing and explaining the information and the required skills. Then, students solve related questions and exercises**.** | **Increase students' information about a topic, and gain basic skills about it**<br>• To learn essentials concepts, rules and theories<br>• To learn basic skills |
| **2. Seminar & Discussion** | Interdicting a topic/subject by the teacher, and encouraging students to participate in short discussion. | **Teaching basic information about a topic, and present its generalizations in an organized and assorted manner.**<br>• To Assimilate basic concepts and generalizations<br>• To grasp new relations |
| **3. Team Collaborative Work (2 to 6)** | Students with diverse capabilities work in small group (2-6). Each group is required to accomplish a task, where each member in the group carries out part of the responsibility. | **Development of various skills; including academic and social skills.**<br>• To develop high intellectual skills (problem solving, critical and creative thinking, analyzing and conclusion, taking decision)<br>• To develop social skills<br>• To develop positive attitude for students toward subjects, teachers, and school<br>• To encourage self-development and self-recognition<br>• To develop management skills<br>• To develop linguistic skills |
| **4. Problem Solving** | Intellectual perception involves a systematic process conducted by individual\group in order to reach to a solution(s) for a problem. | **Enhancement of scientific and research methods for the learner**<br>▪ To develop high intellectual skills<br>  • Problem solving<br>  • Critical thinking<br>  • Creative thinking<br>  • Analyzing and drawing out conclusion<br>  • Decision taking<br>• To utilization information by applying them in real life situations<br>• Te develop self-responsibility and persistency toward finding solutions<br>• To develop linguistic skills |

| | | |
|---|---|---|
| **5. Constructive Learning** | Organizing learning events within the learning environment in a way allows the learner to construct the knowledge himself through introducing basic information about a topic, testing his knowledge about it, enriching it, and helping him to use the obtained knowledge in new situations. | **Construction of knowledge by students themselves.**<br>▪ To develop skills for independent learning<br>• Self study and research<br>• Observation<br>• Comparison<br>• Analyzing and drawing out conclusion<br>• To understand basic information (concept, principle, theory)<br>• Te modify incorrect conceptions<br>• To develop critical and creative thinking<br>• To develop communication skills (ability to dialogue with others)<br>• To apply basic information in new events<br>• To bringing out relations between science, technology and real life |
| **6. Diagnostic/ Prescriptive Teaching** | The emphasis on learning mistakes caused by deficiency in information, inability to express knowledge, confusion in information, misconceptions, or imperfection in performing some skills. | **Developing basic academic knowledge and skills**<br>• To form the fundamentals of an academic material<br>• To develop the basic required skills<br>• To enable most of the students reaching perfection level in conducting certain skill |
| **7. Project-Based Learning** | Intended work involves certain objectives related to the real life. It may include hands-on or mental works, and it may be done individual or as teamwork. | **Relating theories to the practical life, and connect school environment to community. It also reinforce the concept of personalization of learning**<br>• To develop work ethics<br>• To encourage creation and imagination<br>• To develop self- construction of knowledge and self-dependence<br>• To achieve integration between various academic subjects<br>• To develop team-working skills<br>• To encourage open competition between students |
| **8. Investigation & Exploration Learning** | Obtaining knowledge depending on actual practices and real experiments and learning from rights and fouls instead of reliance on textbooks or other | **Developing investigation and exploration skills.**<br>• **To develop scientific and research skills**: conducting experiments, observation, analogy, classification, |

| | | |
|---|---|---|
| | direct consumption of information.<br><br>Stimulating students to generate assumptions, and let them work to proof and generalize them, so that they could be used in similar situations. | compression, and conclusion<br>• To increase the motivation for learning, and develop individual independency and self-responsibility |
| **9. Inquiry-Based Learning** | Motivate student to ask questions about a general subject. Based on student's questions, the student going to conduct a research in certain topic related to the subject. | **Developing intellectual and scientific research skills**<br><br>• To promote independent thinking, and self-identification<br>• To strengthen the relation between the student and his community and environment<br>• To develop learning skills rather than direct teaching<br>• To develop scientific research skills<br>• To develop persistence spirit toward achieving goals |
| **10. Computer-based Learning** | Using computers as a fundamental tool in achieving educational objectives through providing a well-organized and fully-integrated technical support to the learning environment. | **Promoting educational quality, and improving student's academic and practical opportunities in the era of technology**<br><br>• To utilize technology and internet as effective tools in education<br>• To integrate technology in every day exercises within and outside classrooms<br>• To enable learning anytime, and any where<br>• To increase interconnection between student, teacher and family<br>• To promote creativity and increase productivity<br>• To consolidate the concepts of independent-study and continuing-education |
| **11. Individualized Instruction (one-on-one learning with teacher)** | Suitability of the academic content and its quantity and methods of teaching to the capability and interest of the individual learner. | **Personalization of education based on learner's capabilities and interest**<br><br>• To consider individuals' differences of the learners<br>• To identify strength and weakness points of individual and work on them<br>• To develop independent thinking and self-autonomy<br>• To response to the uniqueness needs of |

| | | |
|---|---|---|
| | | the individual<br>• To promote perfection level of individual<br>• To complement other learning resources to teacher effort |
| **12. Independent Study** | Independency of the learner on himself to expand his knowledge in a particular topic according to his capabilities. | **Personalization of education based on learner's capabilities and interest**<br>• To consider individuals' differences of the learners<br>• To develop independent thinking, work, and self-recognition<br>• To consolidate the concepts of independent-study and continuing-education<br>• To promote persistence and appreciation of effort<br>• To build up individual independency and self-responsibility<br>• To develop learner's decision-taking ability and standing for consequences |
| **13. Peer Tutoring** | Exchange knowledge between students at same or different level. It may occur within classroom activities –with the existence of the teacher, or outside the classroom –without the existence of the teacher. | **Create friendly social learning school environment**<br>• To create a kind atmosphere which encourage learning<br>• To encourage constructing positive relationships between learners and teachers<br>• To integrate between formal and informal learning approaches in order to achieve academic and educational objectives |
| **14. Learning by Building- hands on Learning** | Intellectual practicing that including active students' interaction with objects, materials and phenomena on order to obtain knowledge. | **Understanding concepts and scientific essentials through perceivable learning environment**<br>• To develop cogitation and thinking skills while dealing with objects<br>• To develop cognition, observation, and conclusion skills |
| **15. Community Service learning** | Effective participation of the learner in activities serving his community. It also includes the utilization of the community resources and institutions in building up student's education. | **Preparation of civic minded citizens**<br>• To apply epistemic knowledge in real life<br>• To strengthen self-confidence<br>• To promote continuing-learning<br>• To develop social skills<br>• To develop student's professionalism<br>• To balance students responsibilities (academic, and community |

| | | |
|---|---|---|
| | | responsibilities) |
| **16. Field Trips** | Organized learning activities conducted by students outside the classroom under the supervision of the teacher for educational purposes. | **Connect knowledge and learning to the real life, and expand learning sources.**<br>• To strengthen the relation between the learner and his environment<br>• To achieve integration between schools and community<br>• To stimulate thinking through real life problems<br>• To use all human senses in learning |
| **17. Performance and Art Based Learning** | Utilizing arts activities (drama, theater, recitation, painting, art works) in education, sentimental development and creativity of learners. | **Well balance preparation of individual including general tact and creativities**<br>• To encourage invention and creative thinking<br>• To introduce entertaining and recreation to education<br>• To maintain traditional values and heritages<br>• To develop individual sentimental and general tact |
| **18. Stimulating Games** | Organized activities played in light of set of rules, where one or more students competing to achieve clear objectives | **Achieving variety of objectives based on the type of the game**<br>• To equip students with practical skills<br>• To motivate students to learn, play real roles and solve problems<br>• To develop general skills in different fields<br>• To consider individual differences |

***Table 3.5:*** *Example of Learning Modality Forms: Problem Solving Form (one out of eighteen forms)*

**Problem Solving**: Intellectual perception involves a systematic process conducted by individual\group in order to reach to a solution(s) for a problem.

**Approach:** learner-centered

| **Objectives** | **Activities Included** |
|---|---|
| **Enhancement of scientific and research methods for the learner**<br><br>■ To develop high intellectual skills<br>○ Problem solving<br>○ Critical thinking<br>○ Creative thinking<br>○ Analyzing and drawing out conclusion<br>○ Decision taking<br>☐ To utilization information by applying them in real life situations<br>☐ Te develop self-responsibility and persistency toward finding solutions<br>☐ To develop linguistic skills<br><br>☐ **Other(s):**<br>……<br>…… | ■ **Teacher role: introduce problems in a way attracting students' attentions**<br>○ Talking about the problem<br>○ Writing on the board, or using projecting devices<br>○ Reading from book, newspaper or magazines<br>○ Presenting multimedia materials about the problem<br>○ Felid trips<br>■ **Student\group roles: conducting problem solving procedure**<br>☐ Determining the problem to be solved in clear form<br>☐ Collecting data, information and facts related to the problem<br>○ Using reference books<br>○ Conducting experiments and taking notes<br>○ Conducting interviews and questionnaires<br>○ Doing research through the internet<br>☐ Processing the collected data (analyzing, documenting, classifying, etc)<br>☐ Suggesting solutions (possible alternative solutions)<br>○ Considering rational thinking<br>○ Seeking of creative thinking<br>☐ Comparing between the solutions and selecting the more suitable solution(s)<br>○ Generating criteria for comparison through individual/group work, or by consultation with teacher<br>☐ Experimenting and executing the solution<br>○ Individual/team planning for solution execution<br>○ Conducting experiments<br>○ Conducting interviews and questionnaires<br>○ Implementing the solution in reality<br>☐ Evaluating the solution<br>○ Determining the level of validity for the solution<br>○ Providing verification for solution validity<br>○ Identifying difficulty of implementing the solution, and how it could be overcome<br>○ Considering the ability to generalize the solution and implementing it in reality<br>☐ **Other(s):**<br>……<br>…… |

***Table 3.6:*** *Potential Relationship between the Educational/Academic Objectives and the Identified Learning Modalities*

| **Learning Modality** | **Educational Objectives** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Academic Objectives** | | | | | | | | | | | | **Other Objectives** | | | |
| | Develop Attitude | Essentials Background/ Rules | Basic Skills | Higher Level of Perfection | Develop Relations | Searching & Obtaining Data/Information | Criticism Thinking | Creative Thinking | Presenting Results | Independent Thinking | Linking Theory To Practice | **Scientific Research Methods** (Analysis, Synthesis, Decide, Conclude) | **Self & Social Aspects** | **Civic and Cultural Aspects** | **Higher Study & Work Preparation Aspects** | **IT Aspects** |
| **Lecture (Collective teaching)** | | x | x | | | | | | | | | | | | | |
| **Seminar & Discussion** | x | | | | x | | x | | x | | | | o | o | | |
| **Team Collaborative Work (2 to 6)** | x | | | | x | x | x | | x | | x | x | o | o | o | |
| **Problem Solving** | | | | | x | x | x | | | x | | x | | | o | o |
| **Constructive Learning** | x | x | | | x | x | x | x | | x | x | x | | o | o | o |
| **Diagnostic/ Prescriptive Teaching** | | x | x | x | | | | | | | | | | | | |
| **Project-Based Learning** | x | | | | x | x | x | x | x | x | x | | o | o | o | o |
| **Investigation & Exploration Learning** | x | | | | x | x | x | x | x | x | x | x | | o | o | o |
| **Inquiry-Based Learning** | x | | | | x | x | | | | x | x | x | o | o | | |

**X***: Potential match between Learning Modality and Academic objectives*

**O***: Potential match between Learning Modality and other Educational Objectives*

***(Continue, Table 3.6):*** *Potential Relationship between the Educational/Academic Objectives and the Identified Learning Modalities*

| **Learning Modality** | **Educational Objectives** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Academic Objectives** | | | | | | | | | | | | **Other Objectives** | | | |
| | Develop Attitude | Essentials Background/ Rules | Basic Skills | Higher Level of Perfection | Develop Relations | Searching & Obtaining Data/Information | Criticism Thinking | Creative Thinking | Presenting Results | Independent Thinking | Linking Theory To Practice | **Scientific Research Methods** (Analysis, Synthesis, Decide, Conclude) | **Self & Social Aspects** | **Civic and Cultural Aspects** | **Higher Study & Work Preparation Aspects** | **IT Aspects** |
| **Computer-based Learning** | | | | x | | x | | | x | x | x | | | | o | o |
| **Individualized Instruction (one-on-one learning with teacher)** | x | | x | x | | | | x | | x | | | o | | o | o |
| **Independent Stud** | x | | | | | x | x | x | x | x | | x | o | | o | o |
| **Peer Tutoring** | x | | x | x | | | | | | | | | o | | | |
| **Learning by Building-hands on Learning** | x | | | | x | | | x | x | x | x | | | | o | o |
| **Community Service learning** | x | | | | x | x | | | x | x | x | | o | o | o | |
| **Field Trips** | x | x | | | x | | x | | x | | x | | o | o | | |
| **Performance and Art Based Learning** | x | x | | | x | | | x | | | x | | o | o | | |
| **Stimulating Games** | x | | | | x | | | x | | x | x | | o | | | |

**X***: Potential match between Learning Modality and Academic objectives*

**O***: Potential match between Learning Modality and other Educational Objectives*

### 3.2.3 School Physical Environment and the Activity Settings

In view of the enormous development in education and many aspects related to it – either directly or indirectly, many schooling thinkers have called for a new school model that emerges from the educational requirements. The problem with many of the efforts exerted in this respect is that "it is trying to fit 21st century education in 19th century architecture" (Tanner, 1999). To illustrate this, there are many examples where the classroom –in its traditional sense – is used as the basic unit in the design of new schools that are intended to encompass the evolving educational directions. These efforts either forgot –or pretend to have forgotten- that this school models were developed before more than 100 years, where the objectives and the available resources were definitely different than what it is today. If we are sure that the intention is different and the current givens are different, do we have to adhere to the "conventional" classroom. And if we try to "neglect" the name "classroom", does the basic unit of school have to be a rectangular shape with chairs and tables arranged in rows and columns? Another example is the way school facilities are designed to accommodate IT and the use of computer. Although the potentials implied in the use of IT are not only capable to change the way schools are designed but even the way teaching and learning are carried out (Thornburg, 1998, Nair, NSSD, 2005), IT and computer use are still restricted to a prescriptive manner conducted within a specific location; "Computer Lab". Another example is how the school is organized. In most of Saudi Arabia schools –if not all –school is organized around in-defined huge open space that maybe the least used space in the school, surrounded by many identical classrooms. If we believe in the mission of school, why do we design it so that the first thing we see once entering the school is a "lifeless" empty space? Instead, why doesn't the school organize itself around an active space where students are engaged in doing something about learning, such as project-based activities?

The proceeding situations are some examples that clarify the influence of the predetermined image in designing school. One of the main reasons for that is the way school design is approached. The common practice tends to identify "function" in package form and separated from other functions. It means that the function is

determined in general without identifying the level or the patterns of activities within each function. Then, a space within school is allocated to carry out this function, the same things is done with other functions. As a result, school spaces are rigid and designed to support specific form of functions. However, the learning process –especially within leaner-centered learning –is taken place in different ways. It involves various learning functions. Each learning function constitutes of various level of activities that are required by the learner based on his needs and capabilities. This would influence the physical environment of the school in the following way.

The basic learning unit in school (the "classroom" in the conventional school) should be designed to accommodate a range of activities pertaining to different functions. This space does not have to accommodate all the activities within each functions desired to be conducted in the space. For example, the space may be designed to support delivering lectures, conducting group work, individual work, and supporting the use of IT and computers. The use of IT and computers –for example –may be limited to some activities such as word processing and searching the internet. Other form of using IT and computer such as advanced digital graphics would be supported by another space that is more IT oriented. This specialize space (IT Advance Lab) is also designed to support different pattern of learning such as collaborative learning, but the main supported function within this space would be IT. Thus, the overall physical environment of school will support a variety of educational and learning modalities and activities in flexible and integrated manner. Within this approach, the school facility –in terms of accommodating functions and activities –can be divided into the following spatial topologies.

- **The Physical Environment**: represents the widest circle in the spatial level. It is more complex as it should accommodate as much as possible educational functions and learning activities. It is composed of several physical settings.

- **Educational\Learning Setting**: physical setting(s) designed to accommodate a range of functions at different levels based on the intended

activities need to be conducted in the settings. It can be composed of one or more activity settings.

- **Activity Settings**: physical setting or characteristics designed into the physical environment to facilitate the performance of certain activities, actions, and operations required for the dissemination and acquisition of knowledge, or for achieving certain educational objectives. Each activity setting includes several physical components and architectural characteristics based on the main function(s) it needs to supports.

Either on the macro or micro scale –as Nair and Fielding (2005) believe, a great concern should be given to the four major and simultaneous realms of human experience; spatial, psychological, physiological and behavioral. Each realm composed of variety of attributes, and it is nearly impossible to identify simple cause and effect relationship between specific attributes that hold true always. These relationships are always contextual. So, the more human realms stimulated by the physical environment, the better is the physical environment as a place for learning (Taylor, Anne, 1995).

From the discussion, it could be concluded that there is a need to reinvestigate the basic elements (or the "alphabet" of school design) that make up the overall school physical environment. There is a lack of understanding about the basic components of the future school model. One of the main reasons for that is the assumption that what worked fine in the past will still do so. To avoid falling in the same mistake, the activity settings are introduced as an alternative approach for developing the basic structure of the physical environment of future school models. Activity settings are more responsive to educational requirements since they derived from learning activities that are intended to achieve certain educational goals and objectives.

### 3.2.3.1 The Concept of Activity Settings

"**Activity settings**" are understood as the physical spaces designed into the physical environment that supports opportunities for acquiring knowledge (Lippman, Peter C. 2004). They are also identified as elements arranged within the learning environment "within which activities, actions, and operations are performed…" and "…may be understood as both complex and ordered systems where various activities occur concurrently to guide and extend learning…" (Lippman, 2002, October, p. 4). The design characteristics of these activity settings should be guided by considering the type of actions, activities and operations that are intended to occur within them (Lippman, Peter C. 2004).

What activity settings try to achieve in response to the evolving educational paradigm is that learning does not stop once the instructor has left the classroom. Instead, the end of the class meeting marks a transition from one learning mode to another. As a result, school should address real and virtual spaces outside the classroom to ensure that they, too, encourage learning (Brown, 2008). Hidden curriculum or Informal learning settings – those outside the classrooms –present particularly interesting opportunities for pioneering and cultivating new teaching and learning practices (Nair and Fielding, 2005, and Brown, 2008). Flexibility –on the other hand- is a main concern for future school as it should accommodate a variety of learning activities. Flexibility –in the presence of activity settings –is approached through identifying the possible range of activities a space can accommodate comfortably. The minute an activity is not comfortable to do in that space (or there is no setting supporting it), it should not be done there (Nair, interview) (NSSD 2005). In general, diversity of activity settings is desired to make up the overall physical environment so that more human realms (mentioned above) are stimulated during the learning experience (Taylor, 1995, Lackney, 1998, Nair and Fielding 2005).

To promote the quality of activity settings, they are preferred to share the following elements with regard to their users as Tharp and Gallimore (1997) recommended.

- Flexible access to peers of equal greater or lesser skill.
- Influence over the "transactions" that occur in the daily routine.
- Opportunities to actively explore the allowable range of activities permitted in both formal and informal.
- Opportunities to create and redesign their activities and respond to their self-generated changes.
- Low levels of adult direction and monitoring and considerable latitude in what children do and how they do it.

### 3.2.4 Development of the Activity Settings

The aim of an activity setting is to facilitate certain types of activity that is intended to achieve certain objectives. Thus, the key to identify the physical characteristics of the setting is to identify the nature of the activities that are expected to be conducted within the setting. As discussed under learning modalities, each modality includes various types of activities that need to be grouped based on the nature of the activities, so that appropriate activity settings can be developed for each type of learning activities. Before doing that, the type of learning activities and the corresponding learning spaces for future school will be reviewed from the literature.

*Mohammad Zaidan* (1983) identified five main categories of developments high-schools should support to ensure the proper and comprehensive development of the students.

- **Intellectual development** which requires appropriate learning spaces that is furniture with suitable stuff and equipped with divers learning materials and resources. It also requires providing specialize spaces such as laboratories and library.

- **Social development** which requires social center, school club, and large halls for symposium and celebration.

- **Spiritual and sentimental development** which requires places for worship, places for arts and halls for performance, and areas that serve as museum and exhibition.

- **Hygiene development** which requires providing physical educational facilities, nourishment halls, healthcare centers and sanitary facilities.

- **Practical and craftsmen development** which requires providing spaces for hands-on activities such as laboratories and various types of workshops.

More details about the type of activities school should support throughout providing appropriate spaces, where mentioned by Long and Ehrmann (2005).

- Thinking/conceiving spaces (spaces for deliberating)
- Designing spaces (spaces for putting structure, order, and context to free ranging ideas)
- Presenting spaces (spaces for showing things to a group)
- Collaborating spaces (spaces for enabling team activities)
- Debating or negotiating spaces (spaces for facilitating negotiations)
- Documenting spaces (spaces for describing and informing specific activities, objects, or other actions)
- Implementing/associating spaces (spaces for bringing together related things needed to accomplish a task or goal)
- Practicing spaces (spaces for investigating specific disciplines)

- Sensing spaces (spaces for pervasively monitoring a location)

- Operating spaces (spaces for controlling systems, tools, and complex environments)

#### 3.2.4.1 Grouping of Learning Activities

Based on the nature of the activities identified under each learning modality, and benefiting from the literature in this regard, learning activities were grouped into the following categories.

1. **Teachers' activities outside learning spaces**. Including office work, course and lesson preparation either individually or with other teachers, collaborative or inter-disciplinary activities of teachers, meeting and social activities.

2. **Teaching activities centered on the teacher**. The most common form of such activities is the collective teaching or lecture format teaching, where teachers need to communicate with relatively large group of students at the same time.

3. **Individual student activities**. Including individual deskwork tasks that require student to concentrate and produce works such as problem determining and solving, data processing, rational thinking, critical thinking, and etc.

4. **Students' collaborative activities**. Including students work in small group (2-6) to conduct several tasks such as small discussion, project-based activities, brainstorming and so on.

5. **Discussion and exchange of knowledge activities.** Including activities where students and teachers discuss and debate about something, or sharing knowledge about a topic. It also includes presentation activities.

6. **Collecting data and information**. Including activities pertaining to the search of information and obtaining it from different sources and the use of different educational materials.

7. **Hands-on activities**. Including two main types of activity. (1) Scientific experimental activities, where students are exposed to a demonstration, conducting laboratory activities (doing experiment), or doing non-laboratory activities (such as collecting information, planning for experiment, writing reports, discussing works). (2) General hands-on activities such as small project, art work, craftsmen work, and heavy project (mechanical work and construction).

8. **Creative thinking and conceiving activities**. Concerning about quality thinking activities that are intended to develop new and innovative ideas. Examples of such activities are brainstorming session and individual cogitation.

9. **Uses of technology and computers**. Including activities and operations that use IT and computer to increase the efficiency of the learning process, teachers' work and school facilities performance.

10. **Informal learning activities**. Including learning activities outside programmed learning spaces where students are engaging informally in learning activities such as learning from each other and discussing educational or learning matter informally.

11. **Social activities**. Including wide range of activities. (1) Informal learning activities either inside or outside learning spaces. (2) Arts and performance

activities such drama and Poetry. (3) Supporting educational activities such as exhibitions. (4). Developing social and life skills such as forming relationships. (5) Relaxing and recreational activities. (6) Nourishment activities either main or casual.

12. **Community related activities**. Including (1) in-school activities; such as parents' council, community seasonal events, and community use of school facilities. (2) off-campus school activities where students are engage in community services outside the school.

### 3.2.4.2 Proposing of Activity Settings

Based on the identified groups of activities, eighteen activity settings were developed at the beginning. Later, due to some overlap of activities and the need to associate between some activities to accomplish certain functions, the activity settings were reduced to fifteen. These activity settings are not intended to be all that a school facility needs, but they cover most of the aspects demanded by the identified learning modalities. Further activity settings are needed to be developed. For example, activity settings intended for religious and physical educational need further investigation.

The proposed activity settings could be considered as two types. The first type includes activity settings that are defined physical setting (or spaces) intended to facilitate certain function, or a group of activities. The second type includes activity settings with physical characteristics or architectural features that are intended to enhance the overall performance of the facility regarding certain functions or groups of activities. The presence of the two types in the school is necessary to meet the requirements of the identified learning modalities and user's needs emerging from conducting the associate activities within them. The fifteen activity settings are presented in table 3.7.

***Table 3.7**: The Proposed Activity Settings*

| TYPE | ACTIVITY SETTING |
|---|---|
| **Identified Physical Setting (Certain Place)** | 1. Teacher Workplace Activity Setting |
| | 2. Collective Teaching (lecture Format) Activity Setting |
| | 3. Student Individual-Work Activity Setting |
| | 4. Students Collaborative-Work Activity Setting |
| | 5. Discussion and Presentation Activity Setting |
| | 6. Collecting Data and Information Activity Setting |
| | 7. Scientific Experiments and Hands-On Activity Setting |
| | 8. Creative and Conceiving Activity Setting |
| | 9. Technology-Based Learning Activity Setting |
| | 10. Social Activity Setting |
| **Physical Characteristics (general Space)** | 11. Flexible Activities Learning Setting |
| | 12. Community Related Learning Setting |
| | 13. Orderly-Configured Learning Setting |
| | 14. Effective Circulation: Dynamic Learning Setting |
| | 15. High-Operational Performance Learning Setting |

Based on the identified functions and the detailed activities under each one, and benefiting from the literature on the physical requirement pertaining to each identified activity settings, a preliminary physical characteristics or Activity Setting Forms (ASFs) were developed for each identified activity setting. Table 3.8 shows one example –out of fifteen –of Activity Setting Form. The other forms are provided in the Appendix-D.

Considering the main activities under each category and the main physical characteristics of the activity settings identified in the Activity Settings Forms, the relation between them could be traced in table 3.9.

***Table 3.8:*** *Example of Activity Settings Forms: Creative and Conceiving Activity Setting (Stimulating Learning Environment)*

| **Creative and Conceiving Activity Setting {Stimulating Learning Environment}** | |
|---|---|
| **Exterior building form**<br>❑ Distinctive architectural features of the school building<br><br>**Interior characteristics of the building**<br>❑ Plenty of natural light<br>❑ Diversity of artificial light<br>❑ Use of multi colours and textures<br>❑ Create spaces that offer visual choices of shape and form<br>❑ Disperse of technology all around the building<br><br>**Designing the school as an "open textbook"**<br>(Safely exposing some of the building operational systems)<br>❑ Lighting and electricity<br>❑ Air-conditioning and mechanical systems<br>❑ ICT accommodations<br>❑ Lighting an acoustical treatment materials<br><br>❑ Others:..... | **Introducing new learning environments that are pleasant to students**<br>❑ "learning Coffee" (adapted from coffee shop, and used to stimulate discussions)<br>❑ "learning Street" (adapted from public court, and used to stimulate social and cultural activities)<br>❑ "Imagination Exhibition" (adapted from public exhibition, and used to exhibit student inventions)<br><br>**Providing areas (corners) stimulating creative thinking within the main learning spaces or around the supporting spaces**<br>❑ Less formal environment<br>❑ Comfortable seating<br>❑ Sufficiency of natural night, and diversity of artificial light<br>❑ Use of colours and various finishes<br>❑ Outdoor view toward open horizon (wide vista)<br>❑ Indoor windows toward active spaces<br><br>❑ Others:..... |

***Table 3.9:*** *Categories of Activities and the Most Related Activity Settings Intended To Facilitate Them*

| Category of Activity | Main Activities Included | Activity Setting | Flexible Activities Learning Setting | Orderly-Configured Learning Setting | Effective Circulation (Dynamic) Learning Setting | High-Operational Performance Learning Setting |
|---|---|---|---|---|---|---|
| **Teachers' activities outside learning spaces** | – Office work<br>– Course/lesson preparation<br>– Teacher collaborative work<br>– Meeting & social activities | – **Teacher Workplace Activity Setting**<br>– **Collecting Data and Information Activity Setting** | | | | |
| **Teaching activities centered on teacher** | – Collective teaching (lecture format)<br>– Use of resources | – **Collective Teaching Activity Setting**<br>– **Discussion and Presentation Activity Setting** | | | | |
| **Individual student activities** | – individual deskwork<br>– Tasks require concentration<br>– Production | – **Student Individual-Work Activity Setting**<br>– **Collecting Data and Information Activity Setting**<br>– **Creative and Conceiving Activity Setting** | | | | |
| **Students' collaborative activities** | – Diversity of small group activities (discussion, project-based activities, brainstorming | – **Students Collaborative-Work Activity Setting**<br>– **Discussion and Presentation Activity Setting**<br>– **Collecting Data and Information Activity Setting**<br>– **Social Activity Setting** | | | | |
| **Discussion and exchange of knowledge activities** | – discuss and debate<br>– share & exchange of knowledge<br>– Presentation | – **Discussion and Presentation Activity Setting** | | | | |
| **Collecting data and information** | – Search and obtain data<br>– Use of multi-resources and diverse educational materials | – **Collecting Data and Information Activity Setting**<br>– **Technology-Based Learning Activity Setting** | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Hands-on activities** | – Scientific experimental activities<br>– General hands-on activities (small project, art work, craftsmen work, and heavy project)<br>– Art works | – **Scientific Experiments and Hands-On Activity Setting**<br>– **Creative and Conceiving Activity Setting**<br>– **Flexible Activities Learning Setting** | **Flexible Activities Learning Setting** | **Orderly-Configured Learning Setting** | **Effective Circulation (Dynamic) Learning Setting** | **High-Operational Performance Learning Setting** |
| **Creative thinking and conceiving activities** | – Creative thinking (generation of new and innovative ideas and solutions) | – **Creative and Conceiving Activity Setting**<br>– **Technology-Based Learning Activity Setting** | | | | |
| **Uses of technology and computers** | – Increase classroom interaction (communication & exchange)<br>– Educational game and simulation activities<br>– Learning resources<br>– Advance IT work & distance learning<br>– Building as learning tools (building operations) | – **Technology-Based Learning Activity Setting**<br>– **Collecting Data and Information Activity Setting**<br>– **High-Operational Performance Learning Setting** | | | | |
| **Informal learning activities** | – Peer tutoring<br>– Spontaneous discussions<br>– Individual learning and reflection<br>– Extra curriculum activates | – **Social Activity Setting**<br>– **Effective Circulation: Dynamic Learning Setting**<br>– **Flexible Activities Learning Setting** | | | | |
| **Social activities** | – Informal activities in/out side classroom<br>– Social gathering and events<br>– Parent and community participations<br>– Arts and performance<br>– Supporting activities: exhibition<br>– Develop social skills & develop relations<br>– Relaxing & recreation<br>– Time-out and nourishment | – **Social Activity Setting**<br>– **Effective Circulation: Dynamic Learning Setting**<br>– **Creative and Conceiving Activity Setting**<br>– **Community Related Learning Setting**<br>– **Flexible Activities Learning Setting** | | | | |
| **Community related activities** | – Parents participations<br>– Community activities and use of facilities<br>– Student of f-school activities | – **Community Related Learning Setting**<br>– **Social Activity Setting**<br>– **Orderly-Configured Learning Setting** | | | | |

### 3.2.4.3 Significance and Outcomes of the Proposed Activity Settings

The importance of the identified activity settings stems from the following attributes.

1. They are developed insight of the educational objectives. The initiative of developing the activity settings started from identifying the desired educational/academic requirements. Thus, school facility developed based on these activity settings can be considered as a tool to achieve the educational objectives.

2. They are derived from learning activities. Learning activities are sensible means experienced by teachers and learners that are intended to achieve the educational objectives. The activity settings are developed as a direct response to the requirements demand by the learning activities and user's need arising from conducting them. Thus, school facility developed based on these activity settings balances the epistemic and sentimental of the learners. They also can be adapted easily to future changes as they have more potentials to meet evolving educational requirements because they are developed based on a diversity of well established learning activities rather than specific educational curriculum.

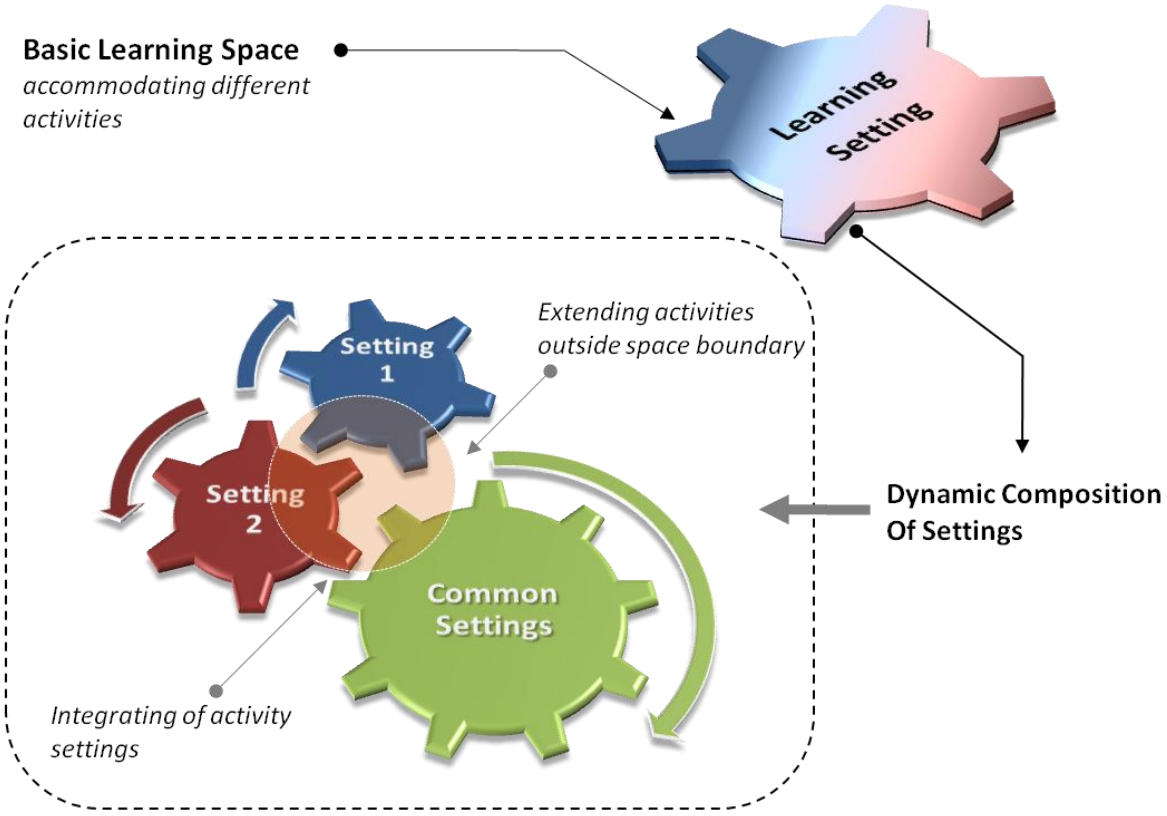
3. They are developed based on the similarity of activities demanded by various learning modalities. Thus, the learning settings of the school are more flexible and integrative (Figure 3.2).

    a. Flexible; because the resulted learning settings compose of variety of activity settings, thus, it can accommodate different functions. In addition, the elements that construct the activity setting are flexible in themselves (such as adjustable furniture and removable walls).

    b. Integrative: because the resulted learning settings can support different forms of learning that are carried out either in the same time or in

sequence. Also, they allow the extending of learning experience outside the boundary of certain space either to practice learning in different mode, or to move to a higher order of physical settings with higher capability to facilitate certain activities.

***Figure 3.2**: Flexibility and Integrity of Activity Settings*



4. They can be addressed at different level. Because the activity settings are developed with different topologies that are intended to facilitate different level of activities within certain functions. Thus, the main learning units can accommodate certain activities regarding many functions, while there will be other spaces intended to accommodate many activities regarding one functions.

5. They consider the hidden curriculum of the learning environment. Because the resulted learning environment takes care of the informal forms of learning that take placed between peers, through nature, and by the physical environment itself.

6. They are maximizing the "net-value" of the facility. Because all spaces under the roof of the school, or within the school fence, are considered as learning spaces. As a results, circulation corridors are utilized to accommodate and foster many learning and educational activities. In addition building components and systems are perceived as effective learning tools.

7. They are configured and arranged based on hierarchy of order. The basic unit considered is the individual and his personal workplace. The individual belongs to a higher level of hierarchy, which in turn, belongs to another higher level. The order does not end at the level of the school, it extend outside to the surrounding community as the larger level (Figure 3.3).

***Figure 3.3**: School Configuration and Space Hierarchy*


8. They are more "environment friendly". Because environmental aspects are considered in all activity settings composing the school. The consideration gave emphasis to site location and spaces orientation for best energy performance. It also emphasizes the use of natural resources such as daylight and natural ventilation.

As a result of these attributes and the potentials they imply, the identified activity settings and the approach developed to generating them can be utilized as a reliable tool to improve future school's design process, or as an instrument to assess and improve the performance of current schools. Figure 3.4 is used to illustrate how these objectives could be conducted. Based on this approach, a number of learning modalities can be identified as a means to achieve certain educational goals and adjectives. The number of the identified learning modalities can be 1, 2 …n. then, for effective implementation of each learning modality (for example LM1) a certain number of activities and sub-activities (A1.1, A1.2…A1.n) have to be conducted to achieve the objectives of LM 1. On the other hands, the school as a facility, should be designed to facilitate as much as possible of the identified learning activities and sub-activities. As a result, there will be a number of physical settings each will have the potential to support diversity of learning activities. However, each physical setting will have certain characteristics that will make it more suitable to accommodate certain learning modality. For example, physical setting 1 (PS1) could have a number of activity settings (A. Setting 1, A. Setting 2, A. Setting n) that would make it having the potential of supporting diversity of activity. However, PS1 will be developed with more physical characteristics(A.S 1.1, A.S. 1.2, and A.S. 1.n) related to A. Setting 1, which will make it more suitable to support certain type of activities (A1.1, A1.2, and A1.n) that are most demanded by LM 1. As a result of the process, the relationship between each learning modality and physical settings can be identified. Consequently, two important component related to school can be obtained; (1) the required physical characteristics and user needs for supporting specific learning modality (the horizontal accumulation for each LM), (2) the importance of a specific physical settings on the overall school performance (the vertical accumulation of each PS).

***Figure 3.4**: The Approach as a Framework for School Design and Assessment*

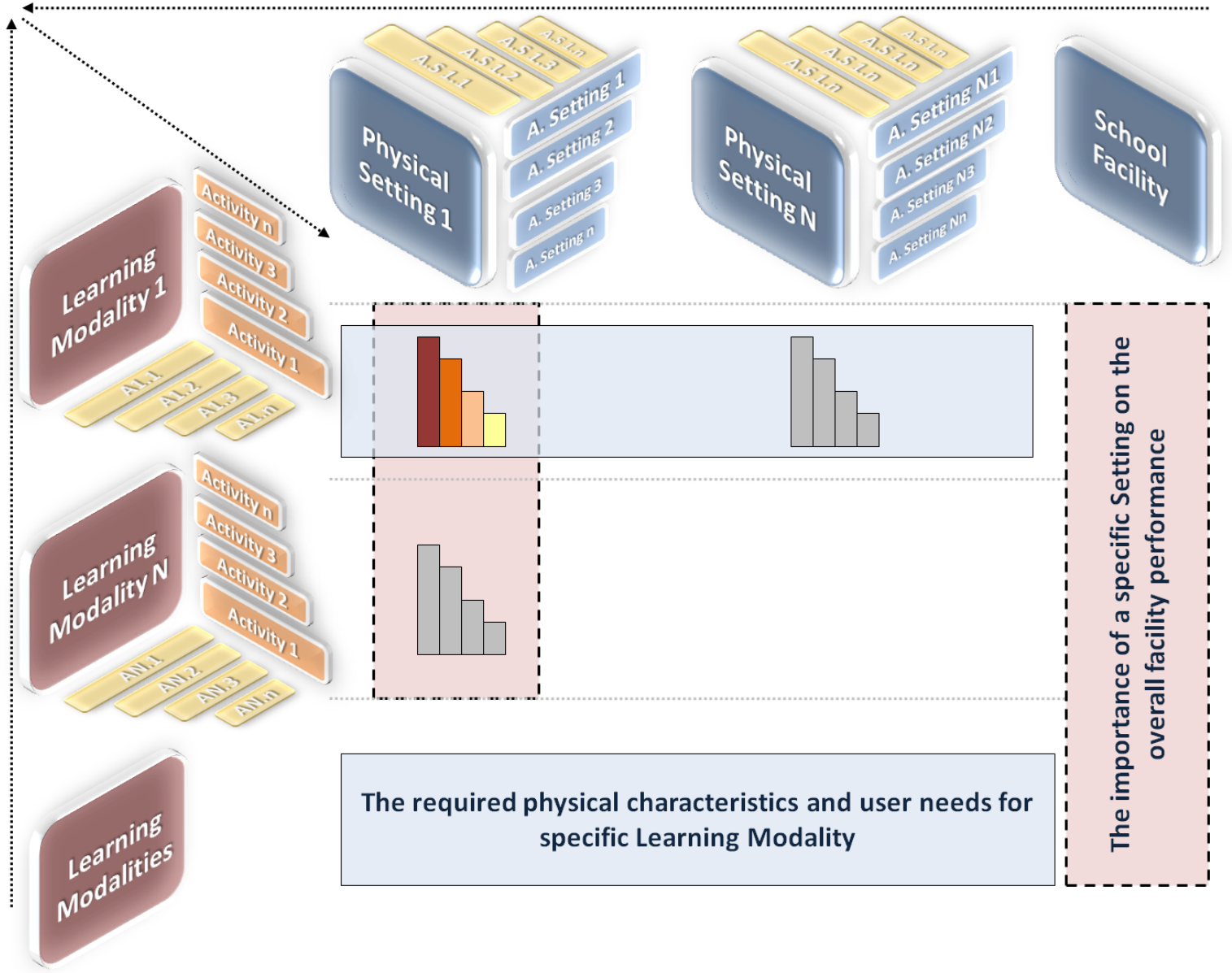
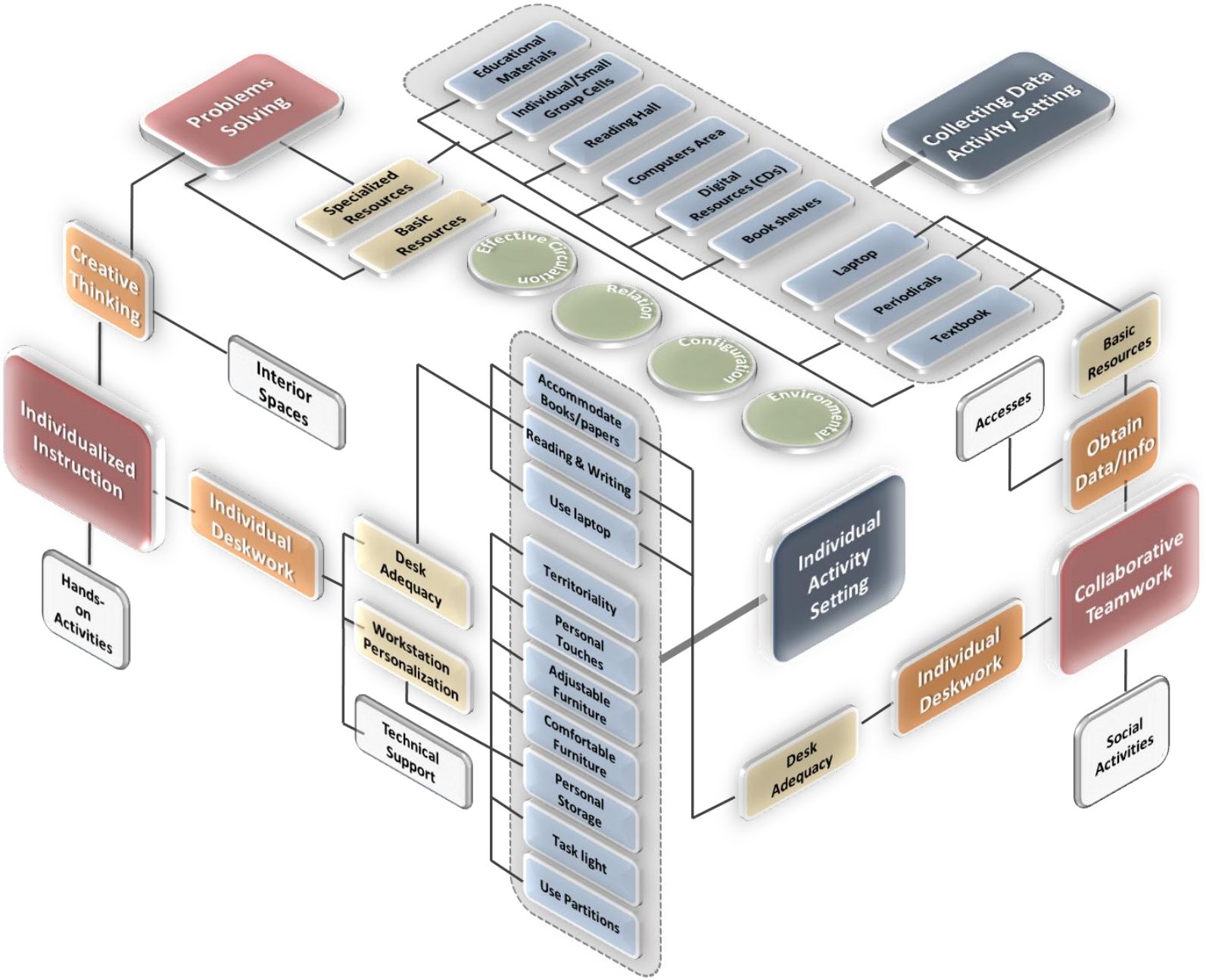


Figure 3.5 illustrates an example of how school physical environment can be addressed in this way, and how the spaces are developed based on the similarity of the activities rather than the differences. Three learning modalities are identified in this example; Collaborative Teamwork, Individual Instruction and Problems Solving. The Collaborative modality involves a number of activities such as individual deskwork, obtaining data and information and social activities. Individualized instruction also involves a number of activities such as individual deskwork, creative thinking and hands-on activities. Although both modalities require individual deskwork, the level of engagement with this type of activities within each modality will be different. While individualized instruction requires more forms or sub-activities of individual deskwork, collaborative modality requires fewer forms. Consequently, more physical characteristics will be required to support individual work within individualized modality than what are required within collaborative modality. This is reflected in the example by assigning three main categories of physical features related to individual deskwork for individualized instruction (Desk Adequacy, Personalization of Workstation, and Technical support), and only one category for individual deskwork for collaborative teamwork (Desk Adequacy). For each category, a numbers of characteristics should be provided to support it. Thus, for a physical setting designed to accommodate extensive use of individualized instruction and individual deskwork it is necessary to provided all the related characteristics. However, for a physical settings intended to accommodate collaborative teamwork, it is required to provide some of the characteristics pertaining to individual deskwork, but not all the characteristics. Similar things can be said if any two learning modalities are traced, such as Collaborative Teamwork and Problems Solving, or Individualized Instruction and Problems Solving.

***Figure 3.5**: Developing of Activity Settings Based on Similarity of Activities*



## 3.3 The State of the Art Related to the Identified Activity Settings

### 3.3.1 Teacher Workspace Activity Setting

Many studies addressed the importance of the overall condition of school facility to deliver high quality education. However, an increasing body of research recently has addressed the importance of teachers' workspace –in specific –as a crucial part for the overall quality of the school facility. The work of Mark Schneider (2003, 2004) and others, showed a common dissatisfaction of teachers with working conditions in their schools. Moreover, these studies indicated that poor teacher workspaces not only do not support work, they even introduce problems that hinder teachers from delivering an adequate education to their students, adversely affect teachers' health, and directly affecting their job performance and teaching effectiveness. As a result, many teachers consider poor working condition one of the main reasons that would increase the likelihood that teachers will leave their school and the teaching profession (Buckley, 2004, Schneider, 2003).

Education reforms increasingly recognize the need for a new professionalism among teachers. Teachers must be regarded as professionals, treated as professionals, and consider themselves as professionals (Moor, 1995 and Lackney, 2003). Unless there is an environment in the schools that sustain this attitude, it will not be feasible to expect improvement to occur in the performance of the teachers and consequently, in the overall educational process. The main step to achieve that would be through providing professional working space for teachers in which they experience their professionalism. As a result, a well thoughtful teacher work space will act as an attractive element for outstanding teachers, rather than a repelling factor for teacher as is the case among poor working space. The literature in this regard identifies several principles that should be considered to create a thoughtful teacher working spaces (Butin Dan, 2000) including: consult teachers about their needs, promoting interdisciplinary planning, strategically locate teachers' offices considering natural monitoring of students activities, and balance

the needs of privacy and collaboration of teachers. In serving these principles, office-based workspace is more preferred as a path toward professionalism of teachers rather than classroom workspace as the base for individual teachers (Butin Dan, 2000). How much further the office-based environment is worked out to satisfy various activities and users' needs will greatly determine how successful is the teachers' workspaces as a professional working environment.

Tracing the characteristics of the physical environment of teachers' workspaces to the three elements of building performance (functional, behavioral and technical) could be identified as follows.

Functionally, the environment is expected to accommodate a variety of activities which balances both individual needs as well as group/team collaborative activities. It also emphasizes the importance of exchanging knowledge and experiences among teacher –as professionals –through providing spaces that would encourage such activities. The relation between the different spaces within the teacher area and the relation of the teacher work area to instruction areas and student activity areas is another importance functional element.

Behaviorally, the physical environment is aimed to strengthen the relation between the space and its user(s). Concepts such as home base, personalization and sense of belonging are potential tools to maintain a strong relationship between the space and its users (Lackney, 2003). The layout of spaces and the distribution of functions are considered as a means to encourage the frequent conducting specific activities (Sztejnberg and Finch, 2006). In addition, satisfying the social needs emerged from formal/informal interaction of teachers is an important aspect that should be taken care by the professional workspace environment (Moore and Lackney, 1995).

Technically, any identified activity should be conducted within safe, secure and healthy working environment, and supported by robust and integrated technology systems including communication and information technology requirements.

### 3.3.2 Collective Teaching (Lecture Format) Activity Setting

Collective teaching or lecture is the most familiar form of teaching in traditional schools. In fact, the whole story regarding the "one-size-fit-all" classroom is about this teaching approach. However, within the evolving paradigm of education, there may still be a need to teach students basic essential concepts or skills that they may need before they start another form of learning (Zitoon, 2003). But, without doubt, this format will not be dominant; it will be needed for specific clear purpose, and should be delivered within short time (Lackney, 2001). As this approach is still expected to exist, it is very important not to embrace to the conventional physical environment in which it is usually carried out. In the evolving paradigm, students will spend more time on project-based work with small groups, and conduct various tasks either individually or collaboratively with others in different locations (Taylor and Vlastos 1975: chapter 1) (Bingler 1998: 16-17 ) (Skill & Young, 2002, p. 24) (Lackney, 2003). As a result –for the lecture to be effective, there will be neither predetermined number of students, nor a specific exclusive place to deliver it. With this approach, the activity setting in which a short lecture is carried out should look very different than the traditional classroom (Stevenson, 2006). The new approach conceptualize collective teaching or lecture format within a self-contained environment (Lackney, 2001) or a Small learning Community (Nair & Filelding, 2005, November), where large school is divided into small communities with students having more control over their learning environment and activity settings. So, the lecture will be intended for certain objectives, and may be held within certain spaces designed around major activities, and equipped with flexible furniture and supported with IT resources.

In general, whatever the shape of the activity setting that would be assigned to deliver a lecture, the design should thoughtfully consider the active zone in which the teacher is working (Butin, 2000). Functionally, the design should address the position of the teacher in the space and the resources available for him to deliver his lecture. Also, it is important to maintain good visual and audio communication between the teacher and

the students within the activity settings. As reported by Hill and Cohen (2005); "…it is not uncommon for students seated in the peripheral portions of the lab to have less than a 15-degree angle of incidence to either projection multimedia or whiteboards". Similar audio difficulty is faced by students as the teacher as teachers look left and right for emphasis. The volume of teacher's voice can diminish by as much as 50-80% for those students to whom the teacher's back is turned (Hill and Cohen 2005).

Behaviorally, there are two points of great importance to consider while design the activity setting. The first is to design the space so that students are focus and encouraged to participate. The second is try to break the "the rule of thumb" that occurs in tradition classroom where students who prefer front seats are those with better academic performance, while students who prefer back seats are lower performers (Sztejnberg & Finch, 2006).

Technically, the design of the setting considers the environmental aspects of the space including providing a thermally comfortable setting to work in, and a good level of lighting and acoustical performance.

### 3.3.3 Student Individual-Work Activity Setting

In conventional high school, the basic building block is the classroom designed for an average of thirty students. The room is connected directly to a main corridor to facilitate mass movement of students. On the other hand, learner-centric school suggests the personal workspace as the alternative of the traditional classroom (Jilk, 1992). In this model of school facility, there will be many spaces for individuals to be in doing various types of activities (Nair, 30p). The focus here is to discus individual workstation in which students can be instructed individually, and be able to work efficiently and be productive. In fact, personalized learning is the main concept in learner-centric paradigm (Keefe & Jenkins, 1998). Personalized learning demands personalized learning space (Lackney, 1998, 2001). And Michael DeArnmond (2002) believes that personalized learning requires introducing non-conventional environment for individual work spaces. The first step toward producing a personalized environment is to maintain a small school community (Keefe & Jenkins, 1998) (DeArnmond 2002), so the individual doesn't feel lost in the large mass of the students (Nair & Fielding, 2005, Nov). The second step toward personalized learning environment is to strength the relation between the individual and the space in which he is assumed to be effective and productive. Some of the concepts that should be considered to design such space are: sense of belonging, ownership (Sanoff, 2002) and home-base environment (Lackney, 1998) (Nair & Fielding, 2005). Some of the strategies that could be applied to achieve these concepts are allowing student to express self-identity and clearly define individual workplace and have control over individual own territoriality (Lackney, 1998). In addition, a student needs personal space in which he can keep his work and personal belongings (Jilk, 1992). Applying these concepts and strategies in school is important because learning settings are places, not just spaces. People form relationships with important spaces in their lives and turn them into places which have meaning, memories, associations, emotional investment and which carry community values (Education Foundation, 2002).

### 3.3.4 Students Collaborative-Work Activity Setting

Collaboration and project-based learning are often listed as key objectives in the planning of learning environment (Fielding, 2002). Education Week (as cited by Prakash Nair, 2003) defines cooperative learning as:

> *"A method of instruction that encourages students to work in small groups, learning material, then presenting what they have learned to other small groups. In doing so, they take responsibility for their own learning as well as their classmates".*

Cooperative learning is a system in which students become both motivated and motivators (Nair, 2003). From the above description, a cooperative learning environment should consider four aspects to obtain effective collaborative activity settings. First, it should consider carrying out a variety of activities that may imply different needs. Second, as most of these activities are performed while working with others, special attention should be given to the social component of the activity setting. Third, all the participants conducting these activities are expected to be motivated, or stimulated to collaborate and think creatively (Fielding, 2002). And finally, in doing these activities, the individual is taking responsibility for his learning, which necessitates expressing self-identity. The first two aspects are closely related, as the name of the approach "collaborative" implies. In a comprehensive study conducted by Susan Wolff (2002), the study suggested that to support and enhance collaborative, project-based learning, the physical environment needed the following functional areas: gathering spaces, planning spaces, resources spaces (e.g., library, media, technology, faculty offices), exploration and discovery spaces, production spaces, community spaces, direct instruction spaces, informal learning spaces, and quiet and reflective spaces. The activity settings pertaining to serve these requirements should be flexible enough to accommodate as much of them,

but within the range of being functional (Nair, 2006, Wolff, 2002), and in an integrative manner so that they allow learning to extend beyond a specific area into another settings without being separated (Lippman, 2004). Furthermore, if all resources –facilities and equipment –are provided within proximate distance (Lackney, 1998), the physical environment will be more like a professional office similar to what is found in real life business (Wolff, 2002, Stevenson, 2006). In considering the second aspect –the social component, it is actually facilitating the creation of intended settings in the way described above. As collaboration is the core objective of this approach, various activity settings may be design around main social space (Nair, 2003). Also, social spots could be introduced in-between (within the horizontal and vertical circulation) to provide smooth transition between functions (Keller & Keller, 1996) (Nair & Fielding, 2005, Nov). These spaces should also be considered as crucial informal learning settings (Brown, 2008). In addition, these informal spaces have the potential to enhance the third component of collaborative activity setting: motivation and stimulation. Changing the environment while moving from one setting to another stimulates brain development and social engagement (Lackney, 1998, Fielding, 2002). Thus, for functional and behavioral considerations, the details of informal spaces should given special attention. Regarding the last component; self-identity, it is related to the concept of home-base and personalization of the activity setting of the individual (Nair & Fielding, 2005, Nov) (Wolff, 2002).

It is also important to extend the concept of collaboration to include teachers and the community –as the larger learning environment (Nair, 2003) (Nair & Fielding, 2005, Nov). Project-based collaboration is most effective when teachers of various interests and abilities work together as a team to deliver a multidisciplinary program for the students (Newton, 2005, Nair, 2003). By working closely with their peers, teachers themselves gain the benefits of collaborative environment, and students benefit from team teaching curricula (Nair, 2003).

Technically, it is important to consider robust technology infrastructure, as it has a great potential to enhance collaborative and interaction between team members while –at

the same time maintaining a high level of personalization (Ramon, 2006, and Ellis, 2001). Another technical consideration should be given to the ability of the environmental systems within the physical environment to be adaptable so that they are suitable for different activities, and capable to accommodate rapid changes.

### 3.3.5 Discussion and Presentation Activity Setting

The constructivist theory has important implications in learning. The theory implies that learning is best served when it is contextual –taking into account the student's understanding, active –engaging students in learning activities that use analysis, debate, and criticism (as opposed to simply memorization), and social –using discussions, direct interaction with experts and peers, and team-based project (Brown, 2007). Considering these implications a within learning environment leads to the adaptation of a learner-centric learning approach. In a learner-centric approach, students are expected to talk and ask questions more often or equal than teachers do (Cuban 1983). Research on the learning environment shows that learner-centric approach is not only beneficial in fostering social relation, students in learner-centric environment exhibit greater achievement and motivation (McCombs & Whisler, 1997). In addition, Communication and interaction is a key to building and sustaining a community of learners (Chickering & Gamson, 1987) and to maintain positive school culture (Sanoff, 2001). As a result, an effective learning activity setting should foster a high level of student –to- student and student –to teacher contacts (George, Erwin & Barnes, 2009).

What are the characteristics of the physical place that would promote such interaction? In a study cited by George, Erwin & Barnes (2009), students and teachers assessed collaboration and communication comparing between conventional classroom and studio-base classroom. The result showed that students feel more conformable to ask questions and contribute to class discussion in studios more than conventional classrooms. Likewise, teachers noticed greater students' engagement in discussion in a studio-based classroom. Teachers also reported that studio classrooms enhanced their ability to communicate with students during class (Erwin & Barnes 2009). In line with the results obtained from the study, research ensured that an informal activity setting provided more opportunity for students' engagement (Bickford & Wright, 2006). Also, deemphasizing classroom front, and use of movable and reconfigurable furniture allow active learning approaches that focus on student interactions and involvement (Bickford

& Wright, 2006, Schuh, 2004). Literature also indicated that the effectiveness of the discussion is inversely related to the group size (Al-Healah, 2002). As the group gets smaller, there is more opportunity for all students to be active and participate. So that it would be preferable in large classrooms to divide students into small groups (Middendorf, 1996). The layout of students' seats in the activity setting is another interesting issue that needs to be considered (Zietoon, 2003). Presentation spaces and resources for different group size is a key element facilitating discussion and the exchange of knowledge (Long & Ehrmann, 2005).

Technically and functionally, it is very important for an activity setting designed to accommodate discussion to utilize technology to the farthest extent. This would include considering various digital presentation tools, and interactive resources and applications (Linnell, Anderson, Fridley, Razmov, 2007) (Ratto, 2003) (Bickford & Wright, 2006).

### 3.3.6 Collecting Data and Information Activity Setting

Learners are not the same, either in term of their intelligences (Gardner, 1983), or in terms of their backgrounds, cultural values as well as their abilities (National Research Council, 2005, Bransfordm 2000). Learner-centric school gives a great emphasis on these issues through providing multi-activities environment supported with different learning resources. The aim of this is to ensure that knowledge is disseminated and acquired for all learners within the school. In this sense, availability of multi-resources for illustrating or obtaining knowledge is crucial for the success of the learning process. There are many types of learning resource materials, tools and equipments that are already available (*Zitoun*, 2003). An inclusive definition of learning resource provided by *Al-Hilah* (2000):

> *"...any form of equipments, tools, educational materials or others, used by teacher or leaner within the classroom or outside it, in order to transfer specific expertise or have an access to it, in a way that increase and enhance the effectiveness of the process of teaching and learning".*

Learning resources have shown positive impact on the achievement of students and increasing their motivation to learn (*Khazem & Jaber* 1989) (*Al-Hilah*, 2002) (Picard, 2004). Within learner-centric school, this observation is even more accepted. As the student feels he is an independent learner, his responsibility and motivation toward enquiring knowledge increases, the thing that is reflected in his desire to search for the best information using all available resources (*Al-Hilah*, 2002, 2004). Although in the evolving paradigm of school, everything is meant to be about learning (Salama, 2004), there is a need for more a specialized area that works as a center of knowledge. Common terms used to describe such space are: "Library media center" or "learning resources area". Today the "Learning resource center" has changed from a room with books to an active, technology-rich learning environment focusing on the learning process as well as

information dissemination (Picard, 2004). In addition to the many formats of the resources, worldwide resources, those are now available to students and teachers. (Picard, 2004). The philosophy behind introducing "learning resource center" comes from two main principles (*Al-Hilah*, 2002, 2004): first; learners have different stylistic cognition, thus it requires providing various learning resources that consider individual differences among learners. Second; various learning methods and resources lead to an increase in the quality and quantity of learning while stimulating more human senses during learning process (NSSD, 2005, Nair & Fledging, 2005 ). Visualizing the role and the importance of the learning resource center, and design it to accommodate variety of activities, and enrich it with technology (Johnson, 2000) goes to the heart of the new paradigm. In this sense, learning resources center become an optimum paradigm for the evolving educational paradigm, and will be the best place within the school to act as the social and academic hub of the school (JISC, 2006) (Picard, 2004). Doing that requires careful consideration to the functional, behavioral and technical components of the physical environment (WDPI, 2008) (Picard, 2004) (JISC, 2006). Functional considerations include: location policy, effective circulation and accessibility, and great flexibility. Behaviorally the space should be designed so that it attracts people to come in. This includes considering space proximity, esthetic and design quality (Sztejnberg & Finch**, 2006)**. However, technical aspects are major issue for the success of such space due to the multi-functional nature of the space. Main technical considerations would include lighting, acoustics, electrical support and technology.

### 3.3.7 Scientific Experiments and Hands-On Activity Setting

According to Roger Schank (Founding Director of the Institute for the Learning Sciences, ILS), learning is through "doing". Roger believes the first mistake in the current educational system has been doing is "schools act as if learning can be disassociated from doing" (Roger Schank, 2002). Others may debate about the level of students' engagement in hands-on activities, but generally, there is consent about the importance of the practical experience for learning (DES, 2004).

According to the Department of Educational and Skills (DES, 2004, USA), Practical activities are an essential part of science learning requiring practical work at all levels. Doing these activities within a group requires learning skills associated with communication and cooperation as well as procedures associated with inquiry (Haury & Rillero, 1996). There are a variety of ideas about what constitutes hands-on learning. In general, practically-based subjects include science, design, technology and art (Building Bulletin 98). Haury and Rillero (1996), compiled views from teachers, curriculum developers, and other writers to arrive at a general notion of hands-on learning in science which encompasses its use in school, museums, and other learning environments. From the collected responses and literature, they came to consider hands-on learning in science to be any educational experience that actively involves people in manipulating objects to gain knowledge or understanding (Haury & Rillero, 1996).

Within high school, the range of activities included in teaching practical science could be classified into two main categories: whole class activities and individual or group activities (DES, 2004). Whole class activities includes demonstration of an experiment (either real or simulated), presentation (either by teacher or students), and discussion (DES, 2004). Usually these activities are carried out at the beginning or at the end of formal lesson. Individual or small group activities (usually 2 to 8) divided into practical activities; where students conducted an experiment, and non-practical activities

including information gathering, planning or writing up experiments and small group discussion (DES, 2004).

When coming to the design of the hands-on activity settings, we have to consider two key influencing issues; greater inclusion of students with special needs, and increased use of IT (DES, 2004). Potential use of IT includes research, presentation and data logging, and sometimes for simulating experiments that are too expensive or time consuming to be carried out lively in school. In addition to these issues, a comprehensive study conducted by the Royal Society of Chemistry, UK, (RSC, 2006) to assess the quality of high schools' laboratory in England showed that the main aspects that teachers thought contributed to good teaching and learning were flexibility of arrangements for pupils, increased IT provision, larger spaces to work in and more attractive environments. Designing an attractive scientific learning environment was also a main influencing factor obtained from another study which surveyed more than 1000 students (DES, 2004). The study found that poorly lit spaces with out-dated furniture was one of the main factors contributing to pupils' dislike of science.

On the other hand, to assure that science accommodations are in line with school philosophy and mission, it is important to consider them in the context of the whole school development plan, and it is important that science staff and pupils are consulted about their teaching and learning needs (DES, 2004). Within the context of learner-centric school and the multi-activities nature of the environment, the collaborative nature of scientific and technological work should be strongly reinforced by frequent team activity (Rutherford and Ahlgren, 1990, p. 189), where the teacher is acting as the director of research, while students working as science-research teams (Small & Petrek, 1992, p. 30). In response to this perception, two types of space could be identified; scientific laboratory setting (lab), and general labs setting (Nair & Fielding, 2005). Scientific labs should be looked at as a suite within which different activities are practiced. This includes typical experimental activities and thinking exercises. This type of space is usually expensive to provide, thus it is less likely to change. Experience has shown that it is better to have a general purpose scientific lab than having very

specialized one (SSS, 2000). A few exceptions could be accepted, for example providing a technology-intensive lab for CAD and graphics work (Nair & Fielding, 2005). However, generic project labs are intended to place project-based learning for both art and science. Messy activities such as work with mud, water or painting could be attached to the general project lab.

For both types, It important to consider spaces and furniture layout, as they are relates to safety and a proper coordination when selecting furniture and services system (SSS, 2000) (DES, 2004).

### 3.3.8 Creative and Conceiving Activity Setting

The learner-centric school puts more emphasis on the individual learner in order to help him constructing his knowledge. Thus, it makes every effort in an attempt to involve all students (Nair, 2006). Since the learner is an active player in this process (in contrast to the traditional paradigm where students is a passive receiver), it is always expected to have a variety of solutions even for the same problem. For example; in a traditional school, -most often- whatever the students know or believe, what is said by the teacher is the only right solution. In contrast, if we take architectural design school as an example, and if there are 10 students who were required to design a house, the final result of the 10 students must be 10 different house models. The example tries to illustrate that in a learner-centric paradigm, creativity is a fundamental principle; it is not an extra choice. As a result, the school building of the evolving paradigm is one that stimulates students to work, learn, participate in activities and think creatively. Stimulating spaces attract people and spark creative thinking. They have the ability to motivate and engage students and teachers in diverse activities (Sanoff, 2001). Stimulating environment raises mental awareness and allows people to absorb the information and ideas that the environment facilitates (Gee, 2006) (Lackney 1998). So, what should be considered when designing learning environment or an activity setting that is stimulating?

The physical environment is considered stimulating, if users are able to scan, comprehend, formulate questions, make decisions and take action effectively (Pesanelli, 1999). David Pesanelli (1999), in his article "*Creative Problem Solving Strategies for 21st Century*" asked the question: "*Why are children in the early grades of school are curious, creative, risk-taking problem solvers and why do those qualities diminish as they proceed upward through the grades*?" He provided an answer:

> *"The first few grades of elementary school rooms tend to be filled with imaginative materials, objects and imagery. As learning becomes more serious in the succeeding grade levels, all that is*

*charming disappears, revealing the true institutional "look" of the environment, with its underlying themes of discipline and control. Though materials and finishes may be a reflection of affluence, an institutional character may still define the total environment".*

The answer suggests that designing a stimulating learning environment requires a lot of creative design ideas, a non-traditional solution (Fielding, 2006). One of these ideas is designing school building as a teaching tool or as "3D textbook" (Salama, 2004). In a teaching school building, everything is information and information is about everything. Another concept in designing stimulating learning environment is to provide changing settings within the learning environment, within which a variety of activities are practiced in flexible and integrated manner (Lackney, 1998) (Wolff, 2002) (Lippman, 2004). The esthetics quality of the school building is another concept to enhance creativity within learning environment that received little attention (Bentley, 2005) like any other building element, exterior and interior esthetics can be broken down into a series of interrelated factors including: style, scale, symbolism, color, finishes, etc. Each will affect how students and faculty perceive their school. If these elements are all studied as pieces of a working whole, esthetic design can be integrated more fully with the mission and goals of education and communities (Bentley, 2005). Spaces such as "NASA", "Disney" and "Star Wars" that have similar values and more other, had better communicate that it is spectacular at an environment, where "Everything is information and information is everything" (Salama, 2004). The common debate when trying to apply these concepts to the learning environment is coast. Prakash Nair in his article "But Are they Learning?" talked about "New Harbor City International Charter school", located in Duluth, Minnesota, as a real example of new paradigm school. Nair mentioned that: "… *It shows why new paradigm schools do not have to be lager nor cost more than traditional schools".*

### 3.3.9 Technology-Based Learning Activity Setting

Unfortunately, the educational system's conventional perception about technology and computing as an independent form of knowledge (considered as independent academic course) has resulted in both their de-contextualization from their wider applications and purposes, and a re-contextualization into a technocratic vision of official prescribed methods for instruction (Tim, 2006). As a result, ITC resources in the school are arranged and organized in a centralized form which leads to miss the great potentials these resources could provide students. This is reflected in the restricted prescriptive manner in which students access ITC and computers (Tim, 2006). Most students' of today's high schools are often more technology savvy than the teachers and adults working in the school. These students representing the "first wave" of the "digital generation", and soon, they will become the teachers of tomorrow (Brown, 2008). Within the evolving paradigm of education, the way students spontaneously response to technology will shape how they will use it in classroom and learning settings (NSSD, 2005). In addition, as educators embrace the "Knowledge" or "Information Age," learning becomes dynamic, interactive, multidisciplinary and problem based (Anstrand & Kirkbride, 2002, Tim, 2006). This would be reflected in students' activities where they will learn more by doing, receiving feedback, and continually refining their understanding and build new knowledge (Bransford, 2000). Most of the new technology by its nature is interactive (Bransford, 2000), and if incorporated properly into school facility, could easily facilitate the creation of the interactive learning environment. Such move is supported by the existing IT components already available for today school including computers, wireless Internet access, videoconferencing, interactive whiteboards and a range of other technology tools that have the capability to change not only the way we use technology, but even the way we design curricula (NSSD, 2005). Supported by these capabilities, classroom's walls are no more the limit of the learning environment. Learning can be extended to the school passages, to the outdoor areas, and even to the house of the student (Brown, 2006). Bransford, John D (2000) summarized the potential

benefits school could obtain through the use of new technology in learning process into five ways:

- Bringing exciting curricula based on real-world problems into the classroom,
- Providing scaffolds and tools to enhance learning,
- Giving students and teachers more opportunities for feedback, reflection, and revision,
- Building local and global communities that include teachers, administrators, students, parents, practicing scientists, and other interested people, and
- Expanding opportunities for teacher learning.

Two main features of technology have recently received more attention in the learning environment, wireless and mobile computers (laptop, or equivalent). Prakash Niar (2000) believes that these two features that school facility cannot afford to be without. Both features are important and complementary to the roles of each other. At a time, the development in technology was described by saying: the information age, the current currency for today's revolution is connectivity, and the key is wireless and computing mobility. Vicki Rogers (2005) cited the benefit reported by McKenzie (2001) of using wireless network and mobile computer. Vicki summarized as follows:

- Ease of movement, laptops can be moved anywhere in the building and require no special furniture.

- Relaxed fit, laptops are easier to accommodate within existing classrooms because of their small size.

- Strategic deployment, laptop computers can be deployed on rolling carts where and when they are needed most, creating one-to-one opportunities that traditional methods of used wired computers do not provide.

- Flexibility, laptops can be used within existing rooms and can be configured to fit the teachers' preference and practices.

- Cleanliness, clutter is eliminated when cables are eliminated.

- Low profile, teachers and students can maintain critical eye contact when vision is not obstructed by bulky monitors.

- Convenience, laptops are readily available and easily stored when not in use. There is minimal set up time and they can be started up quickly without the need to move to a computer with connectivity.

- Simplicity, teachers and students can focus on learning, not on hardware.

Realizing the great potentials and the superior power of technology is a key towards the evolving paradigms. The new direction of utilizing technology in schooling has led to the initiation of new legislation regarding the use of technology. For example; the school system of the New York City (US largest school system) stated that:

> *"All children from the 4th grade should have access to laptop computer and internet when they need it, where they need it".*

Moreover, it has been endorsed by the US Department of Education which said:

> *"Access to technology requires that it be readily at hand for use as need not simply for uses that can be predicted in advance and squeezed into a fixed time slot." (Prakash Nair, 2000)*

To sum up the discussion on technology, it is worth remembering that technology is continuously evolving. What is already available today is enough to forget all what we know about conventional school, and enforce us to be as creative as possible (Nair, 2006, North Carolina, School planning 2002). Proper implementation of technology in school means any space in the school can become a physical learning setting, and many others are "virtual learning settings". Learning becomes not only in classroom, it will be in class, out of class, and between classes. Moreover, the facility itself will become a teaching tool. Activity settings will be more integrated, and much more flexible to adapt to change, and much "much" more powered to enrich the learning environment.

### 3.3.10 Social Activity Setting

School design practice in Saudi Arabia has neglected a minimum of 25 percent of the normal high school daytime. The usual high school day in Saudi Arabia consists of 7 periods each of 45 minutes, with 5 minutes in between, and 30 minutes as official break-time, and 15 minutes for conducting "*Dhuhur Prayer*". If we add 10 minutes before the beginning of the day and 10 minutes after the end of the day, we will get a total of 85 minutes (out of 400 minutes each day) as a minimum time students are expected to socialize. "*A lot of living went on in the five minutes between classes*" said Sean O'Donnell (2007). Susan Wolff (2002) assured this, and said: "*Success is not only in the labs (laboratories) or in the classrooms, but also on the "edges", where the interaction takes place"*.

In addition, the social concept (as it is associated with behavior) does not only mean communication with others for fun and spending some time. In the evolving paradigm of education, social norms are a main pillar to enhance learning and value the search for understanding (Brown & Campione 1994) (Cobb, 1992). In fact, social interaction is one of the main implications of the constructivism theory of learning (Brown, 2008). Moreover, the benefit of positive social interaction does not end by the end of the school; it is a key for lifelong success for the students (O'Donnell 2007). The scope here is not to count the benefits of the positive social interaction; instead, it is to consider how school facility in the evolving paradigm should implement socialization. But before that, it is important to visualize how positive social interaction could work within the learning environment. Human beings have what Malcolm Gladwell (2002) called "social-channel capacity", that limits the number of people they can effectively interact. "150" seems to represent the maximum number of individuals with whom we can have a genuinely social relationship (Dunbar, 1992). Based in this proposition, small school, or small learning community is the first step needed to obtain the benefits of social interaction (Nair, 2005, Nov) (Lackney, 2001). Then there is a need to sustain a positive atmosphere "or school culture" to ensure that; socio-behavioral issues are

constructive. School culture is maintained through a process by which formal and informal learning is integrated where socialization and interaction between teachers and students occur (Salama, 2004) (Ray Oldenburg 1989) (Brown, 2008). Here is another important concept to foster social interaction, which is the informal learning environment. The importance of the informal learning spaces stems from the realization that informal spaces are particularly conducive to working spontaneously and deliberately in small or medium-sized groups (Brown 2006). Fortunately, there are many avenues within school to facilitate informal activities for both learning and socialization. Circulation (can represent 10 to 20 percent of school facility (O'Donnell 2007) is one of the main areas in school that have the potential to radically change the implication of socialization in school (Nair and fielding, 2005) (Brown, 2006) (Ray Oldenburg, 1989). Eating areas is another place of great opportunities for social interaction. What is required in designing food and beverage areas is more than the dining hall that is already available in tradition schools (Building Bulletin, US, 98) (CDE, 2005). Outdoor areas with its possible diversity is another missed opportunity for socialization and learning and can be a valuable resource and laboratory for exploratory learning not possible in built environments (Nair, 2003) (Lackney, 2003). These and other informal spaces within school facility present particularly interesting opportunities for pioneering and cultivating new teaching and learning practices (Brown, 2008).

### 3.3.11 Flexible Activities Learning Setting

We are in a period of radical educational reform that is totally different than what was ever before. Although some of its signs are showing up, many others are still not clear (*Al-Benaa*, p12, 2004). This change is in a continual evolution, and if we are talking today about "smart school", "virtual school" will be the school of the future (*Noubi*, 2004). Flexibility has been always the key when design for future uncertainty. Although it is not easy to design for flexibility, flexibility is one of the most adhered to features of the evolving paradigm school as it is intended for the generic; not the specific (Locker & Olson, 2003). Since the early call for flexible design, the term "flexibility" has represented an abstract concept that needed to be clarified (Rydeen, 2004). In 1968, the Educational Facilities Laboratories published "Educational Change and Architectural Consequences", which stated that (Rydeen, 2004):

*"Flexibility was an abstract concept that needed to be defined in four specific terms…"*

They are: 1) expansible space; can allow for order growth, 2) convertible space; can be economically adapted to program changes, 3) versatile space; serve many functions, and 4) malleable space; can be change "at once and at will". Nowadays, the term "flexibility" has taken on a new meaning; responsive (Rydeen, 2004) (NSSD, 2005). A responsive school facility means space and systems need to be responsive to evolving educational programs, philosophies, delivery methodologies, and student and staff needs (Rydeen, 2004). It also means space and facilities need to be responsive to the ever-expanding societal needs of the community that are served by the school (Rydeen, 2004). The need for flexibility in school facility comes out due to several factors including: (1) school facilities have always had changing needs, (2) Enrollments fluctuate, (3) new program initiatives are regularly conceived, (4) relationship between schools and their communities is constantly evolving, (5) Technology has altered the potential and, in some cases, the delivery of education, and (6) the recent move in education towards smaller

and more personalized learning environments. (Locker & Olson, 2003) (Raywid 1998: 38)

When we come to the actual practice of school facilities, it will be easy to realize why tradition school facilities have failed to accommodate changes. Locker & Olson (2003) ascribed this result to the adapted planning process. They classified school planning approaches into historic planning and futuristic planning. In the historic planning (which often used in traditional school) needs are identified in term of isolated functions, which we then seek to optimize in facility design. This approach tends to identify differences among functions rather than similarities, and can result in buildings that become resistant to change. In the other approach; needs are identified in term of similarities of size, location, and environmental conditioning, and seek to make them as interchangeable and reinterpretable as possible. The futuristic planning –as Locker & Olson belief –requires accepting two truths: the first; the long-term future will not be like it is today. Education will continue to evolve and may make facilities as we know them obsolete. Second; Schools will continue to be under-resourced. In addition to designing for similarities, because of the dynamics and rapidity of curriculum change, curricula have become an unreliable basis for facility design (Anstrand & Kirkbride, 2002). Thus, in order to have a flexible building that is more likely to adapt to change building spaces are better to be arranged around activities that are expected to continue in the future, on other words, activities that are not connected to certain academic curriculum, such as collaborative team work, independent study, practical and hand-on learning, students presentations and Technology-based learning (Nair, 2006). Finally, to obtain optimum results, these approaches need to be implemented at different levels within school environment; starting from individual workstation and basic classroom unit to the whole facility (Greeno, 1998) (Lippman, 2004).

### 3.3.12 Community Related Learning Setting

The role of school should not be ending at preparing students for the future. It should be extent to serve the community and the surrounding environment in which it is located (*Al-Benaa*, 1999). This role is not new for school as it is one of the main educational principles aimed to strengthen the relation between school and its community (*Al-Benaa*, 1999) (AAF, 2007).

The successful experience from many small communities in which school has become the center of community (Anstran & Kirkbride, 2002), in addition to the belief that civic and social aspects will become more important issues schooling has to take care of them, has suggested recent trend in preferring neighborhood schools or walkable (within walkable distance; almost 1600m) school instead of large district school (Stevenson, 2002, NSSD, 2005, PSNC, 2000). Although the concept of community school is not new, the existing model of it needs to be updated (AAF, 2007). Unfortunately, the idea of community school is not adapted in Saudi Arabia, and has not been ever tested seriously before. No valid justifications have been provided in neglecting such a main educational and community concern. By any means, this should not be an excuse to be frustrated, or a reason to continue neglecting the idea. We do not have to "invent the wheel", and we should start from where the other stopped. In this re-visualizing process, we need to review the main aspects that made a school a community school. Literature presented three main aspects (LSD, 2007): **location, relation** and **design**. Community school should be located to the heart of its community (OSSE, 2008). Second; we should identify the relation between the school and its community. Relation describes how tie the school makes to community businesses, organizations, industries and recreational amenities (extend activities beyond its wall) (LSD, 2007). This is a very important point as it will be the base for the design considerations.

In term of design, community should be perceived as the greater environment for school (Jilk, 1992). Thus, the community is the natural extension of the activity settings

available in the school. It means –for students- part of the activities will be conducted outside the wall of the school; in the community (Jilk, 1992). For school –as a facility – it means further valuable assets (such as libraries, exhibitions, parks and sport facilities) made ready for school use. This necessitates developing partnerships with various community organizations and institutions for clear identification of potential exchangeable behalf between the two parties (Jilk, 1992, PSNC, 2000, OSSE, 2008). For example; a partnership between the school and the local municipality will avoid duplication of parks and recreational facilities (Anstran & Kirkbride, 2002). In this sense, school becomes the true symbolic place for it is community that reflects their nature, realization and their national commitment (Jilk, 1992) (Anstran & Kirkbride, 2002). As a result, school will serve not only the students, but all the human components that make the community (*Al-Benaa*, 1999). Thus, it would be designed to work for at least 12 hours daily, 7 days weekly all around the year (*Al-Benaa*, 1999).

As the task of the school becomes more complex, the design consideration will become more demanding. It would require involving different components of the community in the planning process (Anstran & Kirkbride, 2002). Also, the school should be designed so that it reflects its relation with the community (Al-Benaa, 1999). Then, the design should be approached in a away attracting more people to come to school. In addition, it is important to clearly identify areas related to school based on the nature of the function and the type of users (Jilk, 1992) putting in mind safety and security as a main concern. Finally, the design of the school should be flexible so that the building will be capable to accommodate any evolving relation between the school and its community (*Al-Benaa*, 1999).

### 3.3.13 Orderly-Configured Learning Setting

Space configuration concern about how the different parts of the school come to gathers and how the school is organized so that individuals and groups are well fit within the physical environment. When talking about space configuration for a learner-centric school, three main issues should be looked to; **individual learner, social interaction** and **multi-activity nature** of the physical environment.

Individual is the basic component of the learning environment for whom various activities and teaching methods are used so that they could suit as much individuals as possible.

Social interaction/engagement is an individual need for the learning process to be effective (Merriam & Caffaerall, 1999). To avoid the individual getting lost within a large mass, Malcolm Gladwell (2002) proposed "social-channel capacity" that limits the number of people they can effectively interact. Based on Robin Dunbar (1992), 150 represent the maximum number of individual with whom people can have an effective social relationship. Thus, it is important to balance between the needs of individual and the whole when design the physical environment of the school.

On the other hand, the learner-centric school is meant to provide diversity of activity settings that are connected in an integrated and flexible manner. Consequently, the approach adapted to make this connection must be thoughtfully considered. Starting from the last point, as it is explained under the section "Dynamic Circulation", forming the relationship between the various activity settings of the school should be perceived as an open integrated system. Instead of thinking of school settings as places for moving through to get from one activity setting to another, these environments need to be understood as places where the entire system supports knowledge and action so that learning extends across and between settings (Lippman, 2002). It also mains that

transition spaces are not only a path between activity settings; it is an activity setting in itself (Lippman, 2004)?

Going back to the relation between the individual and the groups; there is a need to produce a hierarchy of spaces relationship. Instead of students relating to one large school, the school should be broken into smaller units (Anstrand & Kirkbride, 2002). Hierarchy of spaces and groups as Randall Fielding (2006) belief remains one of the most vital aspects of comfort and security. These hierarchies of space and groups start with student workstations at the smallest level and moving up to largest space in the school (Nair, 2005). As theory suggested students will know each other and their teachers on a more familiar basis, hierarchy of spaces and groups is intended to break the large institution into more easily comprehended and personalized part. Through the hierarchical grouping, learners are encouraged to be part of a smaller group that is related to a lager subpart of the whole (Anstrand & Kirkbride, 2002) (Lackney, 2001) (Nair, 2005). Jeffery Lackney (2001) and Prakash Nair (2005) introduced what they called "Self-Contained Environment" and "Small Learning Community". The key feature of both concepts is the adaptation of the familiar community sense. Small intimate learning communities have been shown to increase student achievement and extends school culture (Lackney, 2001). In addition it been shown to address such problems as reducing the isolation and reducing the discrepancies in the achievement gap that affect poorer children (Sanoff, 2002).

A proposed building unit used to compose the small community structures is "advisory-based" (Nair, 2005). Advisory-based organization has received more attention even within traditional schools as a replacement of the conventional classroom. "Advisory-based" within "small learning community" describes how eight groups of 10 – to- 15 student advisories might be arranged around a central social area and project area.

To sum up the discussion on space configuration, a propose topology level of dividing the school facility has been summarized from the literature (combined the work of Bruce Jilk (1992) with others).

- Individual level: basic building unit based on learner-centric approach
- Collaborative team or group: 2 –to– 6 students work collaboratively
- Family or advisory-based group: 10 –to- 20 students centered around project-based or social area
- Extended family or small learning community: 100 –to – 150 students (composed of groups of extended family or advisory-groups)
- Neighborhoods: of two or more small learning communities
- Multiple small learning communities and neighborhoods across campus

### 3.3.14 Effective Circulation: Dynamic Learning Setting

A learner-centric school is a multi-activities learning environment. When designing for a multi-activity environment, we should look to the spaces "in-between". This is because learning does not stop once the instructor has left the classroom. Instead, the end of the class meeting means a transition from one learning mode to another (Brown, 2008). In addition to the academic value that could be obtained during the transition from one activity to another, educational system is meant to develop students' social and emotional skills (O'Donnell, 2007). In fact, developing the social and emotional aspects are some of the main declared goals set by the Ministry of Education (MOE, Saudi Arabia). If the normal 45 minutes classroom sessions are exclusive for teaching math, physic …etc, where do we expect adolescents will develop these skills?

Susan Wolff (2002), in her comprehensive study about project-based learning environment stated that:

> *"Success is not only in the labs (laboratories) or in the classrooms, but also on the "edges", where the interaction takes place".*

Circulation is one of the most (if not the most) suitable spaces to accommodate informal, social and emotional learning if it is designed to do that (O'Donnell, 2007). Within circulation; a lot of informal learning, spontaneous conservation and unhurried movement are taking place (Nair, 2005). Many times, the only meeting for some of the school users have is areas of circulation (Lackney, 2003). And, if we believe in the importance of the school culture (Sanoff, 2001), it is helpful to consider what Ashraf Salama (2004) said about maintaining school culture.

> *"Culture is maintained in schools through a process by which formal and informal learning is integrated where socialization and interaction between teachers and students occur".*

It is clear that conventional school facilities have lost these opportunities. Peter Lippman (2002) explained the reason of this failure, and tried to provide the way in which learning environment should be organized.

> *"Instead of thinking of school settings as places for moving through to get from one activity setting to another, these environments need to be understood as places where the entire system supports knowledge and action so that learning extends across and between settings".*

In other words, the circulation paths (horizontal and vertical) would function as place for extending, reinforcing, and developing what have been learned in the activity settings (Greeno, 1998, Brown, 2008). To develop a circulation system that is capable to accommodate this function we should be first forget the common practice of "net-to-gross" rule, where circulation considered under the un-programmed area or "wasted" area (O'Donnell, 2007, Nair, 2005, Horwitz, 2005). Second, we should consider circulation as a main social artery of the school (Nair, 2005) (Oldenburg, 1989), through which a panoramic view of what happen in the school could be obtained. Making such places doesn't necessarily require more space, requires thinking about allocating space differently (Oldenburg, 1989). As Jamie Horwitz (2005) belief:

> *"Better environments depend on bringing the inherently integrative thinking of architecture into design decisions that are, all too often, made without architects".*

### 3.3.15 Environmentally High-Performance Activity Setting(s)

The environmental performance of the physical settings involves mainly four components: lighting performance, acoustical performance, thermal comfort, and indoor air quality. These components construct the background environment of the activity settings, and most often the intended performance of them tends to be similar for most educational facilities. In addition, there is robust information about them in the literature. Thus, they are discussed in more details separately.

#### 3.3.15.1Lighting Performance

Until 1950s, natural light dominated in school building as the main means of illumination (James R. Benya, 2001). As a result, more thought was allocated to considerer class time, task performed at hand, and classroom windows' size and room proportion. As a result of industry revolution –particularly in lighting –the task for most today architects become easier and the effort spent to lighten schools naturally– unfortunately –become less. In most cases, rows of fluorescent light producing a uniform lighting level within the intended space is all what could be said about lighting design. Instead of designing ideal lighting environments to enhance students and staff performance, school occupants find themselves adapt to sub-greed lighting environment mainly due to the flexibility of human body and the flexibility of human visual system that has the capability to adjust their posture to whatever light condition available (National Research Council, 2006). Studies by Kuler Lindsten (1992) and the Heschong Mahone Group (1999, 2003), demonstrate a positive correlation between day-lighting and academic performance (cited by Fielding, 2000; NRC, 2006). Natural lighting during daylight hours should be the major source, supplemented when it is fades with artificial light. Due to the continuous spectrum of all light wavelength, including blue, red and green, that appears as bright white, daylight is considered as the standard for color quality

in lighting with a Color Rendering Index (CRI) of 100 (Randall Fielding, 2000; NRC, 2006). A nice brief description regarding incorporating daylight into occupied space is articulated by Greaa D. Ander (2007):

> *"The art and science of proper daylighting design is not so much how to provide enough daylight to an occupied space, but how to do so without any undesirable side effects. It is the careful balancing of heat gain and loss, glare control, and variations in daylight availability".*

Some of the methods used to enhance lighting performance (Ander, 2007) are:

- Balanced, diffuse, glare-free daylight from two or more directions,
- Sufficient light levels for the task in the space,
- Operable shading device to reduce light intensity for audio-visual programs and computer work,
- Windows for interest, relaxation, and communication with outdoors, and
- Exterior shading devices as needed o minimize solar heat gains during the cooling season.

This performance is reflected in what is known as the concept of "cool daylight" by which a systematic approach to daylight design and control is ensured through a combination of glazing systems with low solar heat gain coefficient, shading system, and architectural design (James R. Benya, 2001). The concept of cool daylight should be considered for all the means used to permit daylight to the school building including side window, clearstory window, roof-light, borrowed light and atria.

As a result of increasing recognition of the positive psychological and physiological effect of daylight on healthy and economical operation, a recent trend currently is to benefit from the integrated use of natural and artificial lighting. This has

become more possible with the availability of advanced technology, the efficient daylight products, and the wide diversity of artificial lighting fixtures (James R. Benya, 2001). Proper integration of natural light to artificial lighting system has the potential to reduce life-cycle cost, increase user productivity and reduce greenhouse gases emission (Greaa D. Ander , 2007). In addition to technical and functional benefits of natural light, daylight should be also sought for its unique visual amenity which depends on the balance and composition of light and shade (Architecture and Building Branch, 1999). Many of the dramatic buildings, in the past and today, have been designed with natural daylight as the main architectural design feature.

Regarding the artificial lighting, the challenge is to provide a system that is energy efficient, has a long life, and requires minimal maintenance (James R. Benya, 2001). Another challenge facing lighting design for today school is the tremendous level of flexibility it has to provide (Randall Fielding, 2000). Within a flexible learning environment, lighting should cope with the extensive use of laptop computers and the multi-function feature of most school spaces that often change. While less light level is required for general work, reading and writing, a higher lighting level will be required for detail tasks such as working with machine or conducting fine art work (Architecture and Building Branch, 1999).

On the other hand, the best artificial light in term of light quality is the one that has Color Rendering Index (CRI) and color temperature close to the natural light. This could be achieved by using full-spectrum light combined with polarizing lenses to filter the light. Full-spectrum light is defined as a lamp having a Color Rendering Index (CRI) of 90 or above, and a color temperature of 5000 degree Kelvin or above (Randall Fielding, 2000). Fluorescent light with discontinuance spectrum, flickering light, and spike of color must be avoided. T-8 fluorescent lamp with color temperature of 3000 to 4200 K and CRI of 86 already exists and provide efficient lighting solution (Randall Fielding, 2000). Also, new light source such as light-emitting diodes (LEDs) and induction lamps may dramatically change the way lighting design is approached (James R. Benya, 2001). When electrical light system is to be selected, the following elements

need to be considered. (1) The light source; which concerns primarily on the type of the light, (2) the luminaries; which will depend on the level and pattern of light required, (3) the control; location and ability to control light level, and (4) the instillation; which in best condition combine the demands of both the task and the appearance (Architecture and Building Branch, 1999).

Whatever lighting system is selected, it should be able to overcome direct glare caused by extensive brightness produced by the light fixture itself, and the indirect glare effect caused by reflection from the working service. In addition the system should provide some contrast in brightness level instead of having a uniform dull brightness level which may lead to tiredness and lack of attention (Greaa D. Ander, 2007). Randall Fielding (2000) in his article "*learning, lighting and color*" mentioned what he called myths about lighting in Educational architectural. The first myth he mentioned is using a uniform brightness level, which may works –as he belief- for conventional not for school of future. The second myth is to use the same lamps for all, which is have nothing to do with how we learn, but rather what is easiest to manage.

In the following table (3.10), presents the recommended illumination level on horizontal work surfaces to guide any artificial lighting design achieving efficient human performance.

***Table 3.10:*** *Recommended Illumination Level On Horizontal Work Surfaces For Some Educational Spaces. (Sources: National Research Council, 2006)*

| **Educational Spaces/Location** | **Recommended Illumination Level** |
|---|---|
| Desks | 300-500 lux on a desktop |
| Chalkboard | 500 lux on a vertical surface |
| Corridors | 100 lux on the floor |
| Art room | 500 lux on a desktop, 300 lux in the vertical plane |

### 3.3.15.2 Acoustical Performance

Teachers who must shout to be heard are not effective communicators. Students who must struggle to listen are not effective learners. Experts believe that as many as one-third of all students miss up to 33 percent of the oral communication that occurs in the classroom (Dave Guckelberger, 2003), and 20 percent of the teachers had missed work owing to voice problems corresponding to only 4 percent of other professionals (non-teacher) who have done so (Smith et al, 1998: cited by National Research Council, 2006). The above statistics indicate how serious the problem of ineffective acoustical performance within school environment is.

Several factors have the potential to affect sound level within a particular space including building location, the size and shape of the space, its placement relative to other interior spaces, interior surfaces treatment, ceiling, wall, floor construction, type and location of sound sources, and the strength of the sound they produce (Dave Guckelberger, 2003). Three main sources of noise were identified in literature: exterior noise, background noise, and interior noise. See Figure (3.6).

Exterior noise is usually related to the contextual environment in which the school is located. Airplane, train, buses and vehicles traffic are the main generator of exterior noise. In some situations, exterior noise happens spontaneously and unpredictably.

Background noise is steady in nature and usually is generated by building services and systems such as heating and cooling system, light fixtures, or automobile traffic. The HVAC system is considered as the most predominant source of ambient noise in class (National Research Council, 2006). The fluctuation of light fixtures alone, in many cases had the potential to exceed the recommended limit of acceptable noise level within classrooms set by the American National Standards Institute (ANSI) and the Acoustical Society of America (ASA). To prevent such disturbing effects, these standards do not

allow fluctuation of more than 3dB in any 5-second period. In general, the maximum permissible background-sound level for "typical" classrooms is 35 dB, with a maximum reverberation time of 0.6 to 0.7 second (depending on room volume) (Dave Guckelberger, 2003).

The interior noise is usually generated from the inside of the classroom due to occupants talking, chairs and disks sliding on the floor, and books and papers shuffling. Because noise generated from the inside sources has a similar frequencies generated by teacher's voices, inside noise is considered as the most type detrimental to learning (Melissa Smith, 2002). Speaking and listening are the main way of communication within learning environment. According to Maryland State Department of Education (2006), Sixty percent of classroom learning activities involve listening to and participating in spoken communication. In school, particularly in classrooms, speech is communicated through four main channels: student to student, student to teacher, teacher to student, and teacher to teacher (Acoustical Society of America). If classroom or any space in the school is too reverberant (reverberation time exceeds 0.6s), there is no benefit to increase sound level as it usually done by using amplification. Actually, amplifier may be helpful for the lecture format (teacher to student channel), but it adversely affect the other type of communication channels. The acoustical environment as defined by Borrild (1978) is a mixture of background noise and useful sound in which we continually find ourselves (Melissa Smith, 2002). It could be conclude from the definition that presence of noise within any space is expectable. The problem occurs when this noise exceeds certain level beyond which human performance could be hindered.

Designing a favorable acoustical environment requires a basic understanding of the attributes composing speech intelligibility. Speech intelligibility is "the ability of a student to hear and correctly interpret instruction or discussion" (Melissa Smith, 2002). Two main attributes determine student speech intelligibility: signal-to-noise ratio (SNR) and vibration time (T) (Building Bulletin 93). Signal-to-noise ratio (SNR) is the difference between the intensity of a signal (voice source) and the intensity of the background noise. On order to receive voice message perfectly, ideal SNR within the

classroom is +15 dB, although +9 dB is the minimum acceptable ration. +3 dB SNR creates unacceptable listening environment (Melissa Smith, 2002). The reverberation time (T) is defined as the time taken for the reverberant sound energy to decay to one million of its original intensity (Building Bulletin 93), or: the time, in seconds, it takes for a sound from a source to decrease 60dB once the source stops (Melissa Smith, 2002). More reverberation time means more noise level within the space, which consequently lower the SNR. Also, if it is known that syllables of words are 1/5 of a second, while rest between words are 1/3 of a second (Melissa Smith, 2002) , long reverberation time more than the recommended (0.4 second) will cause speech to blur. The reverberation time is determined by three factors: the volume of the room, its proportion (shape) and the acoustical characteristics of surfaces materials (the absorption coefficient, α) (Building Bulletin 93). Approximately, each doubling of distance reduces the signal strength by roughly 6 dB (Melissa Smith, 2002). Also, since any sound reaching student's location in the classroom is a combination of direct and reflected wave of sound (see Figure 3.7), room shape, geometry and finishing play an important role regarding sound quality.

Inability to maintain the physical environment of the school within an acceptable level will cause the occupant to be exposed to excessive noise which defiantly has the potential to hinder learning process. The impact of this noise varies according to the age of student because the ability to focus on speech is a developmental skill that is evolve and does not mature until ages 13 to 15 years (National Research Council, 2006). Repetition of instruction, teacher's voice drop as it reaches the back of the class, ineffective group discussion, difficulty to learn second language are all symptoms of a noisy environment (Anderson, K, 2001). Since the effect of noise is dependent on the type of noise and demands made by the task such as familiarity with the work, not only listening or speech intelligibility will be impaired but task performance in the presence of noise can be affected as well, especially when student are engaged in tasks that demand higher mental process such as learning new concepts (Melissa Smith, 2002; National Research Council, 2006).

***Figure 3.6**: Typical Source of Noise in School (Source: Building Bulletin 93)*

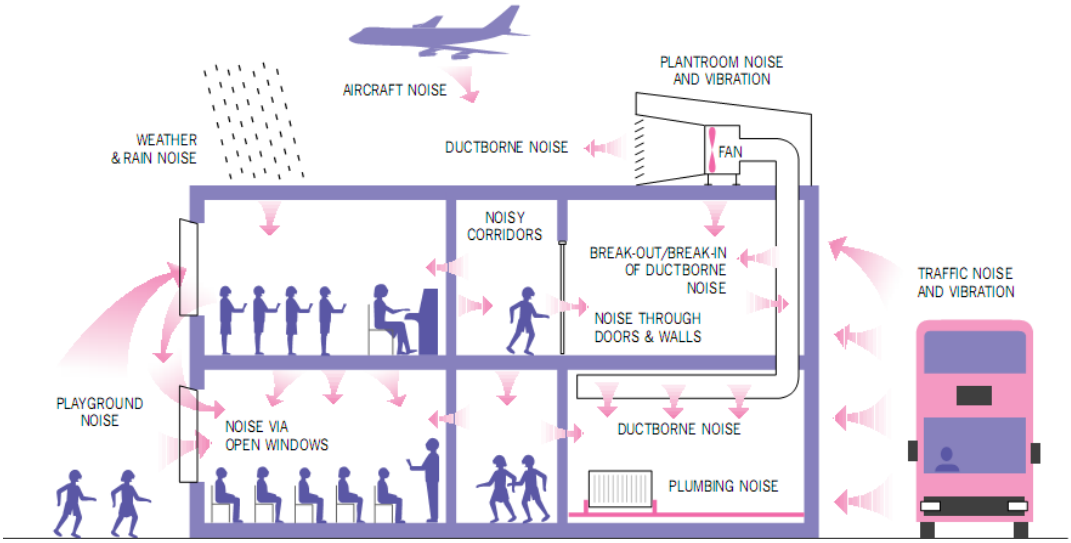
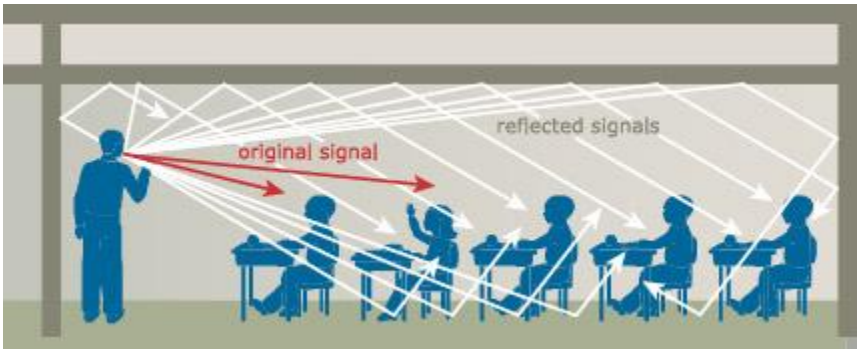



***Figure 3.7**: Sound Reaching Student's Location in the Classroom (Dave Guckelberger, 2003)*



### 3.3.15.3Thermal Performance

There is robust literature on the effect of temperature and humidity on occupant comfort and productivity, primary from studies on office buildings (National Research Council, 2006: fanger, 2000; Sepannen and Fisk, 2005; Wyon, 2004; Wang et al., 2005). Most of these studies showed that productivity declined as temperature and humidity raised too high. Bell, P.A. (1981) believes that the thermal environment may have its most powerful effect through the demands it places on attention capacity, within uncomfortable thermal environment, become impossible to concentrate. In study conducted on Danish students by P Wargocki , DP Wyon, B Matysiak and S Irgens (2005), the result supported that reduced temperatures in summer and increased outdoor air supply rates had positive effect on the performance of schoolwork by children. Moreover, results obtained from controlled researches showed that high ambient temperatures of 35°C and above, was associated with an increase in aggressive behaviors (Richard Smith and Graham Bradley, 1994). Humidity ratio is another parameter that has a negative impact on learning process. As cited by Richard Smith and Graham Bradley (1994), Howarth and Hoffman (1984) claimed that humidity is the most important variable affecting concentration, and was the sole predictor of sleepiness in their study. Also, vigor, social affection and elation are negatively related to humidity level (Sanders and Brizzolara, 1982)

The human perception of the thermal environment depends on four main parameters (National Research Council, 2006): air temperature, mean radiant temperature, humidity level and local air velocity. In addition to these main parameters, tow more other factor also have the potential to affect human perception (Architectural Energy Corporation, 2006): temperature asymmetry and temperature fluctuation. The perception the perception is also influenced by human activity level (metabolic rate) and clothing level (Insulation value of clothing).

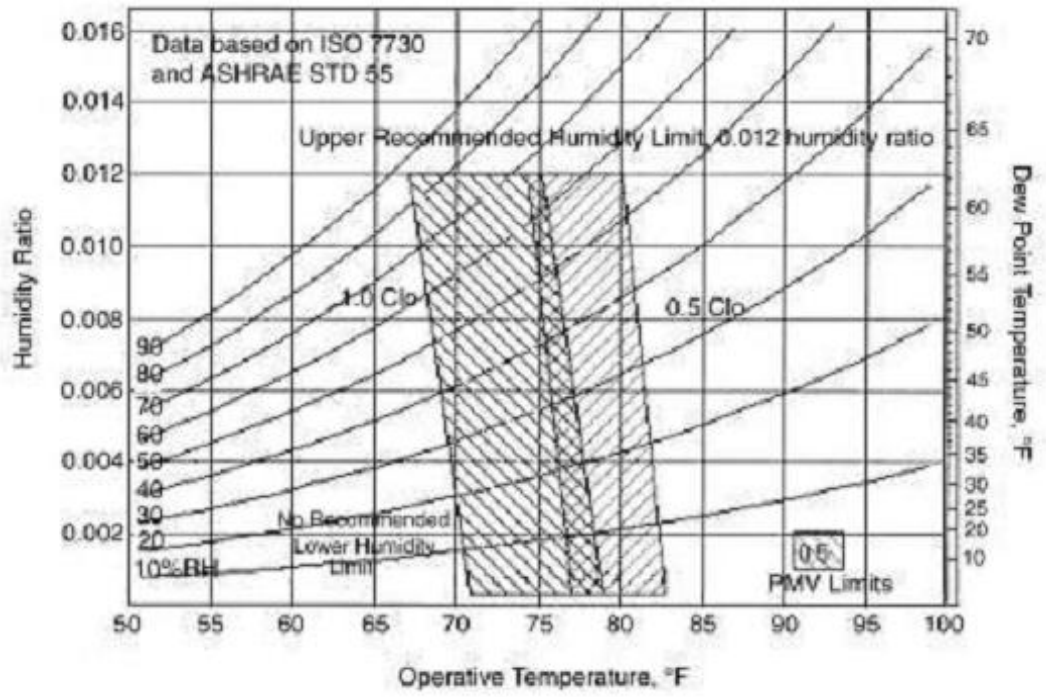
Due to the close relationship between the different variables affecting the thermal comfort of human body, it is more reliable to defined thermal comfort in term of effective temperature (or operative temperature) rather than objective temperature, which considers the combined influence of temperature, humidity and air-flow (Richard Smith and Graham Bradley, 1994). The operative temperature involves both convective effect and radiant effect (heat transfer to and from interior surfaces). As it is noticed, careful designs of building envelop and selection of surfaces finishes and building materials is required to maintain the radiant heat component under control, where special attention should be given to windows and ceiling. Kevan and Howes (1980) in their study about thermal comfort suggested that most people feel comfortable when effective temperature (ET) is within the range 20°C to 22°C. They begin to sweat at 25.5°C ET and find it difficult to maintain moderate work at 26.6°C ET. However, as ASHRE 55-2004 stated; the recommended limits of variation in temperature between head and foot for a seated occupant is 3.6°F and 5.4°F for standing occupant.

The Relative Humidity (RH) for human comfort is about 20% to 60%. Although there are many term used to express the amount of moisture content in the air, ASHRE 55-2004 define Relative Humidity in terms of Humidity Ratio (HR): the ratio of pound of moisture per pound of dry air. The indoor space should be maintained to a humidity ratio below 0.012. For indoor conditions of 75°F and 78°F (23.9°C and 25.6°C), this limit corresponds to RH level of 65% and 59%, respectively. However, design practice normally restricts humidity levels to 60% RH or lower, to limit the potential for condensation of water vapor in buildings (Architectural Energy Corporation, 2006).

On the other hand, the maximum allowable air velocity within an occupied indoor space should be maintained below 40 feet per minute (fpm). For naturally ventilated spaces, air velocity is allowed to be increased so it increase heat lose by skin.

The American Society of Heating Ventilating and Air-conditioning Engineers (ASHRE) codified the relationship between the four main parameters and other variables. The Psychometric Chart (Figure 3.8) is a helpful tool used for designing a responsive thermal environment.

***Figure 3.8**: ASHRAE Thermal Comfort Range (Sources: ASHRAE Standard 55-2004)*



The National Research Council (2006) cited a number of points that need to be considered when applying ASHRE 55-2004 and other thermal standards to school environment. The points are summarized as following:

- The exiting standards are based on study conducted on adult not children
- New adaptive models of thermal comfort were not incorporated.
- Metabolic rate of students vary from time to time, and from location to another.
- School have higher density ratio than most office buildings which

On the other hand, a main concept related to achieve acceptable thermally comfortable environment is the "**Adaptive Principle**". The Adaptive Principle is a function of the actual temperature (operative temperature) and the possibility of change. The idea is if a change occurs such as to produce discomfort, people react in ways which tend to restore their comfort. The result is that people with more opportunities to adapt themselves to the environment or the environment to their own requirements will be less likely to suffer discomfort. Therefore, the width of the comfort zone will be narrow as ±2 if it is measured with purely technical form, while a wider comfort zone will be considerably wider if adaptive strategies are possible such as changing clothes, activities, air movement, or more important if they feel they have options (J. Fergus Nicola and Michael A Humphreys, 2002). Preethi Prakash (2005) cited a study conducted by Brager, Paliaga and de Dear in 2004 to investigate the effect of operable windows on thermal comfort. The study showed that people were willing to accept variations in temperature as long as they have high degree of personal control over their environment.

### 3.3.15.4Indoor Air Quality (IAQ)

The quality of indoor air within a facility is a function of outdoor and indoor air pollutants, thermal conformity, and more expendably, perception of air quality (sensory loads) (National Research Council, 2006). Unfortunately, it has been found that the air we breathe within most enclosed physical environments is often of inadequate quality and sometimes it saturated with harmful containments. In American schools, one out of five children is exposed to poor air quality (General Accounting Office 1995). Moreover, in the US, students exposed to poor air quality miss 14 million days of school each year due to asthma (EPA, 2003). In a study conducted in Europe, 800 students from eight different schools were involved to investigate the relation between students' performance and the indoor air quality (David Sundersingh and David W. Bearg, 2003). The collocated data indicated health symptoms and student's ability to concentrate as related to CO2 measured in the classroom. In a classroom where CO2 levels were found to be high, students' scores were low and health symptoms were high. Generally, the study concluded that poor IAQ could reduce student's ability to perform specific mental tasks requiring concentration, calculating or memory. A comprehensive literature review was conducted by Mark J. Mendell & Garvin A. Heath (2003/2004) to identify the potential adverse affect of school environment – especially IAQ- in academic performance. The review concluded that the most persuasive direct evidence showed increases in indoor concentrations of nitrogen dioxide and outdoor concentrations of several specific pollutants to be related to reduce school attendance. On the other hand, the most persuasive indirect evidence showed indoor dampness and microbiologic pollutants to be related to asthma and respiratory infections, which have in turn been related to reduced performance and attendance.

Inadequate ventilation, inefficient filtration, and poor cleanliness of air handling unit are the most documented reasons for poor indoor air quality (Sundersingh and Bearg, 2003). Most recommendations from the Occupational Safety and Health Administration (OSHA) and the National Institute of Occupational Safety and Health (NIOSH) now call

for between fifteen and twenty cubic feet of air per minute per person (See Table 3.11). The concentration of carbon dioxide –which is considered as a key indicator of school indoor air quality –in all teaching and learning spaces, when measured at seated head height and averaged over the whole day, should not exceed 1500ppm (Building Bulletin 2005).

***Table 3.11:*** *ASHRE Standard (62-1999); Recommend Ventilation for Acceptable Indoor Air Quality*

| **Application / Area** | **Cubic Feet per Person** |
|---|---|
| Classrooms | 15 |
| Music Rooms | 15 |
| Libraries | 15 |
| Auditoriums | 15 |
| Spectator Sport Areas | 15 |
| Playing Floor | 20 |
| Office Space | 20 |
| Cafeteria | 20 |
| Kitchen or Cooking | 20 |
| Patient Rooms | 20 |

Pollutants contained within indoor air could cause a wide range of health problem from asthma to flu-like symptoms such as headaches, sore throats, memory problems, joint pain, and nausea. Children and adults with pre-existing health problems including asthma, allergies, or chemical sensitivities are more expected to suffer from such poor environment (Building Bulletin 2005). Asthma, in particular, is of enormous concern, as it is the leading cause of school absenteeism due to chronic disease (Healthy School 2005). In this regard, the American Association of School Administrators (2005) developed a detailed check list addressing the needs of students with Asthma.

In general, air pollutants can be categorized into outdoor air pollutants, and indoor air pollutants. The main outdoor air pollutants that could be found around school facilities may include Carbon monoxide, CO; Nitrogen dioxide, NO2; Sulphur dioxide, SO2; Ozone, O3; Particulate matter, PM; Benzene; 1, 3-Butadiene; Lead and dust (Building Bulletin 2005, National Research Council, 2006).

The main sources of these outdoor air pollutants are: road transportation systems which includes traffic junctions and car parks, especially underground parking, combined heat and power plants discharges from industrial processes which emit a wide range of substance, building ventilation system exhaust discharges intensive agricultural processes, soil borne pollutants, and construction and demolition activities. These pollutants could ingress the school facility and pollute the indoor air either through students, faculty, and staff who are exposed to outdoor polluted air before they inter the school, or through building cracks, windows, doors, rooftop, or via underground tangency with building foundation and below-grade structure. (Building Bulletin 2005, National Research Council, 2006)

The first step to avoid outdoor air pollutants is to give more attention to the selection of the site and the activities surrounding it, and how to minimize the immigration of pollutants to the inside of the building. Also, especial concern should be given to outdoor landscaping around the building, outdoor exposed building surfaces, weather condition and wind characteristics and the ability of the building envelop to prevent uncontrolled ingress of pollutants.

Regarding indoor air pollutants, typical air pollutants found in school include: environmental tobacco smoke, formaldehyde, volatile organic compounds, carbon monoxide, nitrogen oxides, carbon dioxide, allergens, pathogens, radon, pesticides, dust, odor, ozone and particulate matter. Main indoor air pollutants and their sources are identified below. (Sundersingh and Bearg, 2003, Building Bulletin 2005, National Research Council, 2006)

- Environmental tobacco smoke; smoke generated from burning tobacco products that emit smoke such as cigarette, pipe, and cigar.

- Formaldehyde; released by sources such as particleboard, plywood, textiles, adhesives, foam insulation, and pressed wood furniture, cabinets and shelving.

- Volatile organic compounds (VOCs); released by sources such as cleaning-products, personal care products, paint, wood preservatives, fracturing , and copying machines.

- Carbon oxide; released during incomplete combustion or invented gas, kerosene heaters, boilers, furnaces, auto, truck, and bus exhausts.

- Nitrogen oxide; released in the process of combustion, welding and tobacco smoke.

- Carbon dioxide; released in all combustion process and human aspiration.

- Allergens and pathogens; released by humans, animals, the environment, carpet, dust collecting sources, cooling towers, dirty cooling coils, humidifiers, condensate drains, and ductwork.

- Radon; released by the earth around some buildings, well water and even some masonry blocks.

- Pesticides; applied close or within the building

- Dust; released from the soil, fleecy surfaces, and pollen, burning wood, oil, or burning coal.

- Odor; released from people and from various materials that may found in school building.

- Ozone; emitted from office equipment such as photocopiers and laser printers and has been known to cause respiratory problems.

- Particulate matter; includes solid particles ranging in size from ultra fine (<0.1 μ m) to relatively large (>10 μ m). They are emitted by humans, building materials, fibers, mold, and pet dander.

It could be noticed from the above discussion that some spaces within school facilities particularly science laboratories, are a potential source of indoor pollutants. Also, building occupants and the activities they perform within school facilities could be another source for pollution. In addition, building services and systems, if not maintained and performed properly, they are expected to be main sources for indoor pollutants.

# CHAPTER 4

## THE STATUS OF THE PUBLIC SCHOOLS FACILITIES IN SAUDI ARABIA: A CASE STUDY

### 4.1 Facility Assessment Methods

Before discussing the status of the selected sample of school facilities, it is important to review the methods of assessing building performance and the means used to forward lessons learned into future projects.

As old as the building history, learning from previous deficiencies has been always useful to avoid them in next building. At a time, master architects with multi-skills (planner, designer, craftsmen and builder) took the responsibility of delivering the required building for the client, who had a strong relationship with the architect. Thus, lesson learned from previous building had its direct way back to the attended person, the architect. As the demand in construction increased, and the complicity of construction projects increased, the responsibility of delivering the desired building was disseminated among more parties. As a result, the need to predict the actual performance of the next project became a main concern. In turn, there was a need to have a mechanism by which the lesson learned has its way to the next project, and building evaluation was the common approach to achieve that. The early form of building evaluation process was informal and conducted by individual effort of design corporations or construction companies for their own benefits. There was a lack for generalized evaluation process that serves to the benefit of the whole building industry rather than the individual entities. The major building failures –especially those related to safety, health and general welfare of building occupants –have resulted in regulations that historically have been the only

systematic and research-based source of information on building design (Preiser, 1988). Over the years, construction grew more complex, and new building types emerged which led to the evolving of building regulation into building codes that aim to control the critical aspects of building. In addition, to increase the fit between the building and the institution's activities those taken placed in it, standards were developed from previous experience on different building types. Having an agreed upon technical reference and acceptable optional standards, form the base for more formalized and generalized evaluation process. When psychological and human sociological considerations were linked to design, the study of environment and behavior became a new discipline and knowledge from this discipline was needed to be applied to building evaluation (Preiser, 1988).

However, involving the human dimension into the formula to determine whether the facility is successful for conduct particular tasks or not, introduced challenging to the practice of evaluation. The physical environment should no more perceive as a shelter, it is settings in which various activities are engaged in by different groups of people (Preiser and Vischer, 2005). For example, in school facility, people may be individual, small group, large group, or the whole occupants. It may be a student, teacher, staff, administrator or any combination of them. Activities mainly are learning activities including lecture, group work, individual work, project-based work, art work, performance work and physical exercise, or social activities such as eating relaxing talking, or any other form of activities. For each level and type of users conducting certain types of activities, the physical setting has to be equipped with certain requirements and qualities to be considered as a suitable and supporting place. Perceiving evaluation in this way promotes it from being evaluative process to be a base for making physical improvement since evaluation becomes a method of identifying needs (Sanoff, re:2007).

Considering school facilities in particular, in spite of conducting many assessments that aim to improve the performance of school facilities, an agreement has emerged that many school facilities do not properly serve the functions for which they were designed

(Sanoff, 1992). The reason as Lackney (2001) believed was because most of the assessments pertaining to public school were conducted at administrative level and looked primarily to the absorbable condition of the physical structure and building systems. However, the required school assessment is the one that explicitly address educational adequacy, which defined by Lackney (2001) as the relationship between the physical condition of the school and the various educational goals and activities that taken place within the school facility.

### 4.1.1 Performance Concept

The term building performance is relating to the ability of a building to contribute to the fulfilling of the function of its intended use (Williams, 1993).

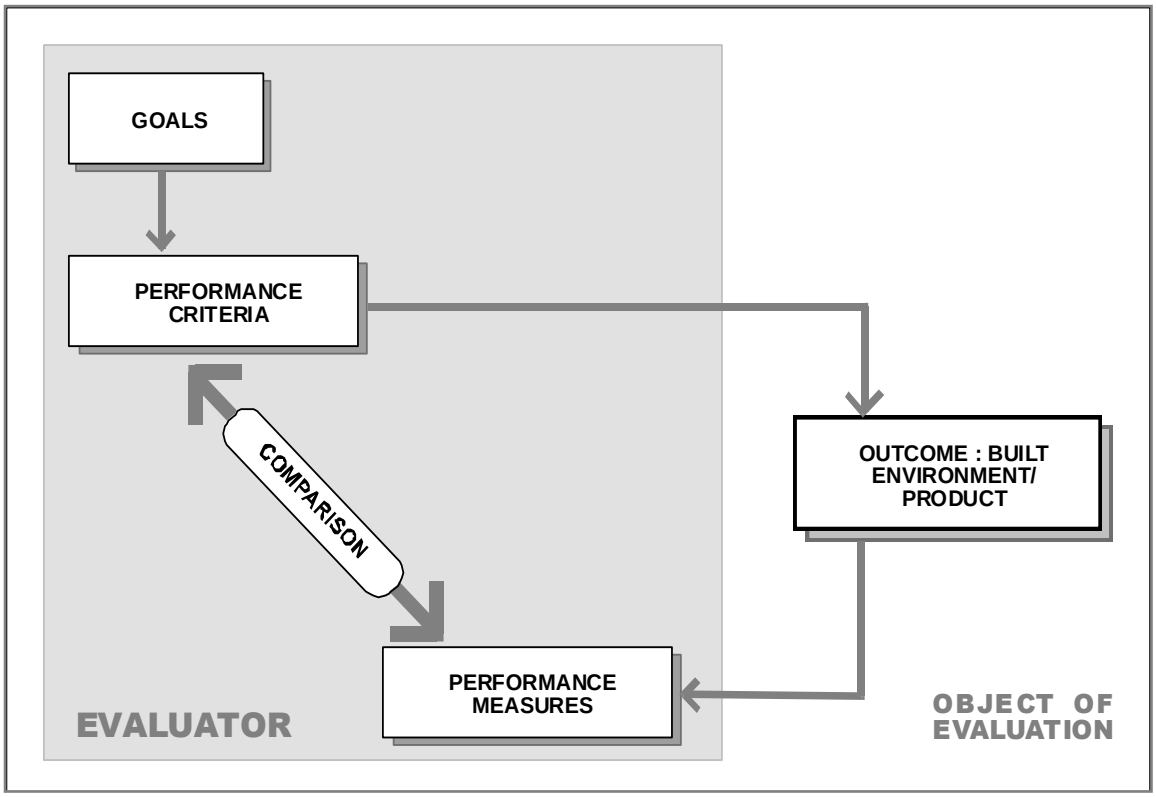
In the act of evaluation, the performance concept is about comparing the actual performance of the building (performance measures) to appropriate performance criteria and a conclusion is reached on how successful the building performance has been (Preiser, 1988) (Figure 4.1). An evaluation, combined with recommendations for improvement, is used for feedback and feedforward regarding the performance of similar buildings.

The performance concept is widely used in daily life. For example, purchasing a notebook computer based on processor's speed, system memory, hard drive capacity, video/graphics acceleration, battery longevity, connectivity options and others desired performance measures is a performance based decision. Another common example is the stock market, where multiple performance measures are used, analyzed and compared to certain criteria (or indicators) in regular basis.

In the professional world, the field of law, medicines, and business use evaluative process that are a main reason for their professionalism and credibility. Business education gives emphasis to evaluation through the use of the case-study approach as

well as simulation models. All the three fields have made significant progress and achieved a high degree of professionalism because of their rigorous use of evaluation and feedback in assessing past successes and failures in their respective areas of specialization. (Preiser 1988)

***Figure 4.1**: The Performance Concept (Source: Preiser, 1988)*




In contrast to previous disciplines, the performance concept was accepted for widespread use in building industry only by the late 1970s (Leslie, 1985). Today, due to the rationales advantages of performance-based approaches, performance concept became a worldwide trend in building industry (Preiser 2001).

#### 4.1.1.1 Benefits of the Performance Concept

The performance concept has been accepted because of it many benefits (Preiser, 1988, 2005):

- Increased objectivity; opinions are replaced by criteria, or at least, opinions are presented based on certain criteria.

- Clarity of Measures; aspects of building under concern are clarified through predefined performance criteria.

- Enhanced communication; performance measures and criteria became the common language for the evaluation process among all participants.

- Incentive for innovation and the development of alternatives; design solutions are accepted as long as they meet the required performance.

- Aid in decision making; decisions are supported by actual measures and well identified criteria.

- Advanced professionalism; continuous process of refining and generating of performance measure and criteria relating to building industry.

#### 4.1.1.2 Formulating and Applying Performance Criteria

The performance criteria used in an evaluation should be developed from the goals and objectives set for the mission in use. The goal is the desired general result while the objective is the desired specific result (Sanoff, re: 2007). Both the goals and the objectives should be derived from the needs of the actual users of the facility, and they should imply values held by individuals, groups, organizations, or entire socio-political systems (Preiser, 1988). Definable and measurable criteria are developed in response to the objectives, and in a way it supports the accomplishment of the general goals.

In applying the criteria, it important to determine wither the criteria are pertaining to the original intend use of the facility, the current use, or the future use (Preiser, 1988). In some cases the criteria are applied for the original use but for new goals and objectives which usually associated with new tasks and activities, as is the case in this study. Also, it is important to determine the targeted people for whom the criteria are intended. The criteria may develop for experts, for organization's management, or for the basic users of the facility.

#### 4.1.1.3 Users' Needs and Performance Levels

Satisfying the needs and expectations of the users who occupying a building for the purpose of conducting certain business are crucial for the quality of that business. In school facilities, the main actors and the core business are all about the users; students and teachers. Thus, their needs must be given more attention in planning, designing, and evaluating the physical settings. However, the human needs arise out of users' interaction with a range of settings in the built environment have been transformed into a hierarchal system –based on priorities –by Lang and Burnette (1974). Level one, concerns health, safety and security. Level two, concerns function and efficiency. Level three, concerns psychological comfort and satisfaction. This historic constructs were transformed and

synthesized by Preiser (1983) and Vischer (1989) into the "habitability framework" for building performance levels as following:

- Health, safety, and security performance;
- functional, efficiency, and workflow performance; and
- Psychological, social, cultural, and aesthetic performance.

The three hierarchical levels are also parallel to the categories of standards and guidelines available to building designers and professionals (Preiser and Schramm, 2005). Level one pertains to building codes and life safety standards. Level two pertains to the state-of-art knowledge about building types and systems. Level three pertains to research-based design guidelines, which are less codified, but nevertheless equally important for designers and building occupants. Assimilation of users' needs within performance-based framework will facilitate implementing them in evaluation projects or in programming and designing process. Also, it will make it easier to benefit from the evaluation outcomes in the programming and designing since they follow a similar framework.

On the other hands, the adequacy of a building to satisfy the needs of its occupants does not necessarily follow the way they are prioritized. In other words, if a building performs satisfactorily regarding level one comparing to another building perform satisfactorily regarding level two or three, does not means that the first building perform better for its occupants than building two. This is because the complexity of human experience in perceiving the physical environment (Nair and Fledging, 2005). In reality, the physical environment has the potential to stimulate the four major realms of human experience: spatial (such as closed or open space), psychological (such as joyful or boring), physiological (such as warm or cool), and behavioral (such as working independently or in a team). Each realm is characterized by multiple attributes. The

interconnection between the attributes is non-linear, which means it is almost impossible to identify simple cause and effect that would hold true always. Nair and Fledging (2005) explained this point by given the following example:

> *"Research tells us that as humans our sense of sight (physiological realm) is a major emotional (psychological realm) trigger. We also know that our emotions can elicit a physical response (behavioral realm) such as laughter when we are happy, facilitated to a lesser or greater degree by the environment (spatial realm)."*

### 4.1.2 Post-Occupancy Evaluation (POE): Definitions

The concept of building performance is the major philosophical and theoretical foundation of POE (Preiser, 1988). POE is generally described as the process of systematically evaluating the degree to which occupied building meet user needs and organizational goals (Jeffery, 2001). An early attempt to define POE provided by Friedman et al (1978) who defined POE as:

> *"An appraisal of the degree to which a designed setting satisfies and supports explicit and implicit human needs and values".*

A recent and more comprehensive definition of POE was offered by Preiser el al (1988):

> *"Is the process of evaluating building in a systematic and rigorous manner after they have been built and occupied for some time".*

POEs focus in building occupants and their needs, perceptions, and expectations. In addition, POE takes into account the owners' and operators' needs. From this perspective, building's performance indicates how well it works to satisfy the client organization's goals and objectives, as well as the needs of the individuals in that

organization. Thus, providing insight into the consequences of past design decisions and the resulting building performance is one of the main tasks of POEs.

#### 4.1.2.1 Brief History of POE

During the 1960s, due to several problems related to the built environment in some institutions such as mental hospital and prisons, the early significant POE efforts were made (Osmond, 1966). Further works where conducted by Edward T. Hall (1966) and Robert Sommer (1969) to investigate the behavioral aspects which resulted from the interaction between the people and their physical environment. The early 1960s, witnessed a tremendous growth in the research that focus in the relationship between human behavior and building, which led to the creation of the field of environmental design research and the formation of interdisciplinary professional associations, such as the Environmental Design Research Association in 1968 (Preiser, 1988). During this early stage, College dormitories –because of their ready availability for research –were one of the main building types used to conduct POE projects (Hsia, 1967, and Preiser, 1969). The 1970s, due to the considerable body of knowledge obtained from different evaluation methods, building types, and occupant groups, POEs research experienced a dramatic increase (Preiser and Daish, 1983). And in the late 1970s, the first book on POE was published by Friedman et al, 1978). In the 1980s, POE developed into a discipline of its own. A number of advanced theory, methods, strategies and applications of POE have been produced during this period (Preiser, 1988). Recently, POE is an international trend for conducting facility evaluations and various activities relating to building delivery process and life cycle (Preiser, 2001). The latest step in the evolution of POE is toward building performance evaluation (BPE) and universal design evaluation (UDE), which consider not only the facility but also the forces that shape them such as political, economical, social, etc.

#### 4.1.2.2 Key features of POE:

- Building users are all people with an interest in a building Including administrations, staff, customers or clients, visitors, owners, design and maintenance teams, and particular interest groups such as the disabled. Of course, the most important group is that who has day-to-day activities in the building.

- POE differs significantly from conventional surveys, assessments and market research. It uses the direct, unmediated experiences of building users as the basis for evaluating how a building works for its intended use.

- POE is usually "softer" than most technical evaluations. POEs address questions related to the psychological needs, activities, attitudes, expectations and goals of the people and organization using a facility, including maintenance, building operations, and design-related decisions. Other evaluations assess the building and its operation regardless of its occupants.

- POE can be used for many purposes, including fine tuning new buildings, managing buildings problems, and developing new facilities. Organizations also find it valuable when establishing maintenance, replacement, purchasing or supply policies, preparing for refurbishment, or selecting accommodation for purchase or rent.

#### 4.1.2.3 Outcomes of POE

The outcomes of POE vary according to the time-frames used (Prieser, 2001, 2005). Generally, the time-frames are divided into three main periods: short-term, medium-term and long-term.

- Short-term outcomes, include user feedback on problems in building performance within a specific sub-phase of the building life cycle, and identification of appropriate solutions. Usually, they provide immediate actions.

- Medium-term outcomes, including applying the positive and negative lesson learned to inform subsequent phases within a building's life cycle, as well as the next building delivery cycle. Usually, its time-frame ranges 3 to 5 years.

- Long-term outcomes, are aimed at the strategic plan, creation of databases, clearinghouses and the generation of planning and design criteria for specific building types. Usually, its time-frame ranges 5 to 25 years.

#### 4.1.2.4 POE Requirements of Accountability for Design Quality

Forwarding the outcomes of POE into the design of next project or for the purpose of adopting an existing facility to new goals and objectives is one of the main tasks of POE. However, in order to use POE as an instrument of accountability for design quality, POE should meet certain requirements. Joiner (1996) summarized accountability requirements for POE, set by the New Zealand governmental architect's office.

- POE must account for physical and socio-cultural phenomena simultaneously. It has to account for how well buildings accommodate the expectations of occupants and their organizational structure (Perin, 1970).

- Findings must be useful for design and more than just judgments on historical events. They must be presented and reference in ways that make them easy to use and accessible in design (Joiner et al., 1987)

- It should have the intention to build a database from the accumulated finding of building evaluations that would inform the design and modification of buildings (Zeisel, 1989).

- If building evaluations are going to be undertaken when necessary and to be effective as a process of negotiation, they must be structured as a process that could be arranged within an organization from the bottom up. It must be participatory and non-directed procedure that could be initiated by anyone (Kernohan et al., 1992).

#### 4.1.2.5 POE within Educational Facilities

The early effort of applying the concept of post-occupancy evaluation in school facilities belongs to the late 1960s. At that time, the Building Performance Research Unit (BPRU) at the University of Strathclyde appraised over fifty schools in Scotland (BPRU, 1972). The appraisal is considered as one of the seminal examples of the post-occupancy evaluation of school buildings.

In the United States, Preiser and Ranbinowitz (1988) reported on a diagnostic post-occupancy evaluation conducted in four schools in Columbus during 1975. The evaluation covered three main aspects of building performance including technical, functional and behavioral aspects.

In Scotland also, the Council of Educational Facility Planners International (CEFPI) tried in 1986 to standardize the evaluation of school facilities through developing an evaluation guide that covers various aspects relating to school facilities and educational adequacy (Hawkins and Lilley, 1998).

Sanoff (1992, 1994, and 2001) presents a series of school design and evaluation projects conducted over several decades of practice in Carolina and elsewhere that uses multi-dimensional approaches to collect data on school facility performance. Sanoff accented in his work the importance of participation of building users and the community in the process of evaluating and designing the school facilities.

The Ministry of Education in New Zealand has conducting hundreds of post-occupancy projects over the last years (NZME). As a result of the accumulative experience in conducting POE of school facilities, they are working in developing a standard process or "template" to enable schools to undertake their own evaluations.

#### 4.1.2.6 Benefits of POE for Educational Facilities

Based on the classification of POE outcomes, and the various advantages of conducting POE in building industry, the potential benefits of POE in educational design practice could be summarized as following (Figure 4.2).

**a. Short-term benefits:**

- Identify school facilities problems and provide solutions for them.
- Supports fine-tuning through suggesting minor adjustments, or in case of renovation of existing settings.
- Proactive facility management responsive to building user value and expectations.

- Improve space utilization and feedback on building performance.

- Improve attitude of building occupants through active involvement in the evaluation process, and increase commitment to solutions, and more willingness to accept limitations.

- Support development of policy as reflected in design and planning guide.

- Understanding of performance implication of changes by budget cut.

- Accelerates organizational learning by allowing decision-making to build on successes and not repeated failures.

**b. Medium-term benefits:**

- Create mechanisms for quality monitoring, similar to using student testing to identify under-performing schools, where decision-makers are notified when a building does not reach a given standard.

- Built-in capability for facility adaptation to organizational change and growth over time, including recycling of facilities into new uses, through providing justifications.

- Significant cost saving in the building process and through out the building lifecycle.

- Accountability for building performance by design professionals and owners.

- Help to show the implications of various design alternatives devised to meet lowered budgets, enabling the achievement of the best level of quality and performance within these constraints.

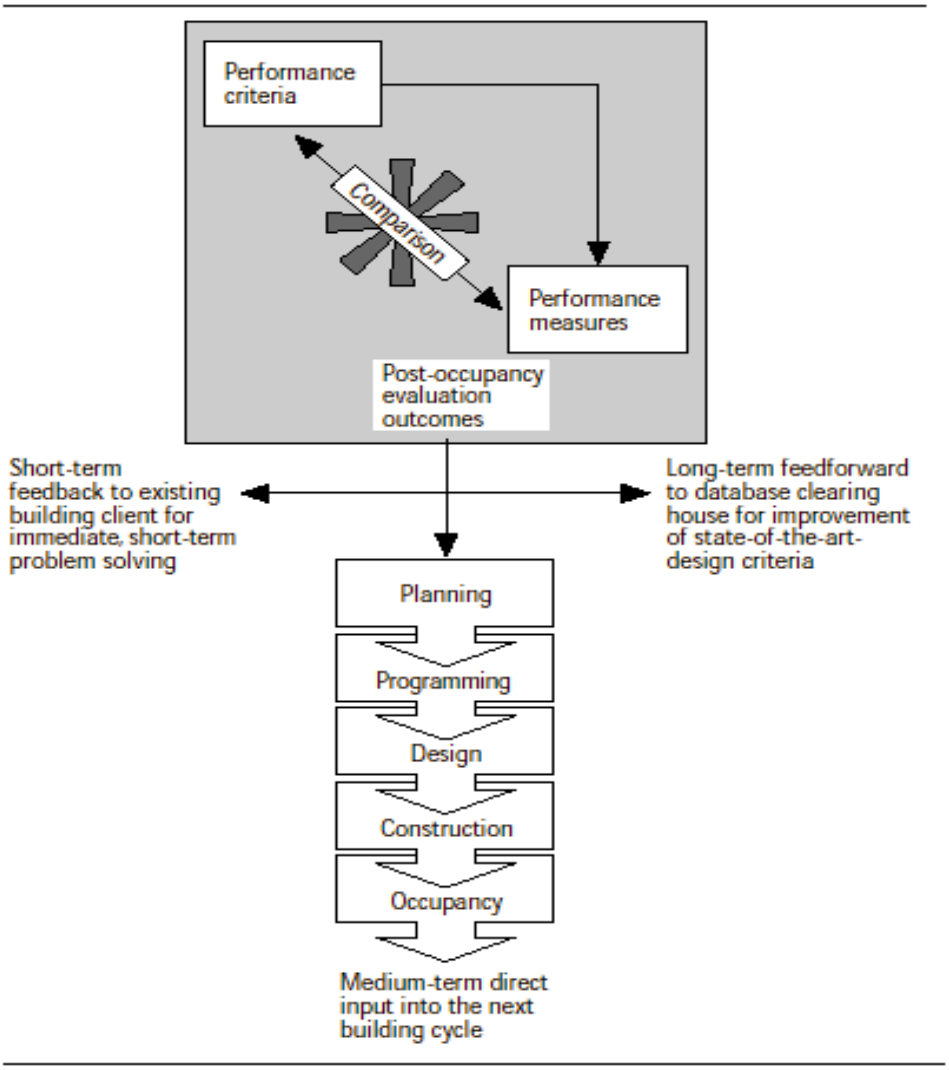
**c. Long -term benefits:**

- Long-term improvements in school facilities performance as a result of lessons learned from the failures and successes of previous facilities performances.

- Improvement of design databases, standards, criteria and guidance literature.

- Improve measurement of school facility performance through quantification.

***Figure 4.2**: The Performance Concept in the Building Delivery Process and the Outcomes of POE (Source: Preiser, 1983)*



### 4.1.2.7 Participation in the Practice of POE

The most important benefit of a POE is its positive influence upon the delivery of human and appropriate environments for people through improvements in the programming and planning of buildings (Preiser, 2001). Thus, there is a need for a mechanism to transfer the people's needs into the programming of buildings. And the shortest way to achieve this is through the direct involvement of teacher and students users into the planning, designing and operating of the learning environments.

The most important benefit of a POE is its positive influence upon the delivery of human and appropriate environments for people through improvements in the programming and planning of buildings (Preiser, 2001). Thus, there is a need for a mechanism to transfer the people's needs into the programming of buildings. And the shortest way to achieve this is through the direct involvement of teachers and students users into the planning, designing and operating of the learning environments.

Users' participation does not only bring designers and users closer, it enhances the participants' sense of ownership of the resulting change to built environment (Kernohan and Gray, 1996). According to Forester (1999), "participation processes may enable participants to learn not only from arguments about possibilities, but from all multiple issues, alternatives, concerns, and conflicts related to their experiences that they discuss with each other. The participation processes encourage people to learn from each other. It reminds them of their own concerns, brings into focus values they have and obligations they wish to emphasize or interests they wish to satisfy. If participation is utilized to its full potentials, it is the key to achieve "Educational Commissioning". Educational Commissioning is a new concept in school planning that refers to a process through which teachers, students, and even parents and community partners are educated as to the design intent of newly constructed school facility (Lackney, Jeffery). The objective of

educational commissioning is to provide all occupants with the necessary knowledge to use school facilities as optimally as possible for teaching and learning.

Henry Sanoff (1992, 2001) demonstrated how building evaluation techniques – including POE –used to support a participatory approach to building facility design. The process was used to promote the collaboration of students, teachers, the local community, and central authorities in the design of a new elementary school in North Carolina.

#### 4.1.2.8 Participation and Accountable Design Decision

As it is demonstrated before, one of the main benefits of conducting POE is to provide accountability for decision-making. To obtain reliable data from the POE that would facilitate decision-making process, one should distinguish between the evaluative part of the POE, and the informative implications of it. Evaluative results are usually reached when pure technical approaches are adopted, and expert knowledge dominating the process (Kernohan and Gray, 1996). The evaluative approach is often initiated by authorities and decision makers to develop policies, strategies, and standards. It relies on forcing the professional community to be aware of an issue then respond to it (Salama, 2005). The process is described as "Top-Down" approach. On the other hand, informative results are reached when occupants' wealth of experience and knowledge about their building are brought into focus (Kernohan and Gray, 1996). In contrast to evaluative approaches, informative approaches initiative led by the community and building users, and facilitated by professionals. It relies heavily on developing a common understanding, a common language, and develops sense of responsibility toward the built environment (Salama, 2005). The informative process is described as "Down-Top" approach.

Within the context of Saudi Arabia, while more emphasis has been placed on the top-down approach, to achieve a responsive learning environment, the down-top

approach has been oversimplified or ignored. Both approaches are needed to obtain accountability for design decisions.

#### 4.1.2.9 Forms of Participation and the Role of Evaluator/Architect

Although post-occupancy evaluation is based on the idea that better living space can be designed by asking users about their needs (Preiser, 2001), the level to which users participate in actual process of design or evaluation are not well defined. According to Henry Sanoff –who conducted extensive work in occupants' participation in school design and assessment –the type and degree of participation depends on several factors and vary in accord with the circumstances. For Alexander (1975) the most modest kind of participation is the kind where the user helps to shape a building by acting as a client of an architect. And the fullest kind of participation is the kind where users actually built their building for themselves. Jim Burns (1979) classifies participation into four categories or experiences:

1. Awareness; involves discovering or rediscovering the realities of a given environment. It uses same language based on the experience of participants in the field of the proposed change.

2. Perception; entails going from awareness of the situation to understanding it and its physical, social, cultural, and economic implications. It means sharing with each other so that understanding, objectives, and expectations of all participants become recourses for planning and not hidden agendas that could disrupt the project later on.

3. Decision Making; concentrates on working from awareness and perception to a program for the situation under consideration. Participants make actual

physical design based on their priorities which are used by professionals as a resource to synthesize alternatives and final plans.

4. Implementation; when the how-to, where-to, when-to, and who-will-do-it must be added to what people want and how the building will look. People must stay involved throughout the processes; in other words, take responsibility with professionals to see that there are result (Hurwitz, 1975).

In this regards, Flutter and Rudduck (2005) conducted study that aimed to explore how schools, architects and planners have consulted young people about the school environment and what impact students' consultation and participation have had on planning and design. They concluded that:

> *Although students' participation is commonly adopted in policy document and it crop up frequently in project objectives but its interpretation and application vary. Few, if any, of the initiatives described in their review could reach the top form of participation".*

Participation does not imply that there is no longer a role for institutional leaders. It only means that dialogue is necessary between teachers, students, parents, educational administrators and public officials to meet the various needs (Sanoff, 2000).

The architect/evaluator role is to facilitate the school community's ability to reach decisions about the learning environment through an easily understood process. Achieving that requires making people aware of environmental alternatives. Facilitation is a means of bringing people together to determine what they wish to do and helping them find ways in deciding how to do it. Facilitator should make everyone feel included

in what is going on, and what individual say is listened by the group. Facilitation can also include the use of variety of techniques whereby non-professional people can organize themselves to create change in the environment. (Sanoff, re: 2007)

### 4.1.3 Elements of Building Performance

Human needs arise out of users' interaction with a range of settings in the built environment were transformed into three performance levels as follows:

- Level 1: Health, safety, and security performance
- Level 2: Functional, efficiency, and workflow performance
- Level 3: Psychological, social, cultural, and aesthetic performance

Although attributes within each level may interact or even conflict with each other –which requires resolution -, they were grouped into three main categories; technical, functional, and behavioral (Prieser et al, 1988). Technical elements include attributes within level one, functional elements include attributes within level 2, and behavioral elements include attributes within level three. To conceptualize how the three elements of performance interact with building occupants (the users) and the setting in which they are, corresponding hierarchal levels of occupants and physical settings need to be developed. Occupants may be differentiated in term of their number into individual, groups, and organization. Physical settings, on the other hand, are set apart in ascending of scale including specific settings, rooms, buildings, and facilities. In conducting a comprehensive evaluation, the three elements of building performance (technical, functional, and behavioral) should be considered for different occupant numbers (individual, groups, and organization), and for the divers physical scale (settings, rooms,

building, and facility). Although three main components of building performance are separated in this framework, they act –in reality –in non-linear way creating the overall environment perception (Nair and Fledging, 2005).

#### 4.1.3.1 Technical Elements of Performance

Technical elements can be described as the background environment, a kind of "stage" for activities (Preiser et al, 1988), and as such are often unnoticed. This includes basic survival issues such as fire safety and sanitation. It also includes the general issues related to the welfare of people that covered by environmental control systems, or what is known as element of high performance.

Technical elements usually can be measured by instruments. Thus, In order to truly evaluate the degree of achievement of technical standards, some objective system of measurement is desirable. Although many of the technical elements are codified, their performance is often measured for the operation of the building regardless of its occupants. For the purpose of this study, purely technical evaluation will be excluded and are only considered in terms of their effect on occupants' health, safety, functional performance and physical comfort.

Main attributes of technical performance that will be investigated in this thesis include the following:

- Energy conservation
- Indoor air quality
- Thermal comfort
- Electrical support
- Sanitation support
- Fire safety

- Visual comfort
- Acoustical comfort
- facility security

#### 4.1.3.2 Functional Elements of Performance

The functional elements of the building directly support the activities within it, and they must be responsive to the specific needs of the organizations and occupants, both quantitatively and qualitatively (Preiser et al 1995).

Functional elements deal with the fit between the building and the clients' activities. Therefore, clients' organizations and activities should be supported by the performance of a wide range of functional building attributes. In contrast to technical elements, functional elements vary widely according to the type of buildings and the specific objectives and activities within various physical setting levels.

Main attributes of functional performance that will be investigated in this thesis include the following:

- Spatial adequacy
- Spatial quality
- Spaces relations
- Spaces configuration
- Circulation
- Technology
- Flexibility
- Storage
- Furniture

#### 4.1.3.3 Behavioral Element of Performance

Behavioral elements of performance link occupants' activities and satisfaction with the physical environment (Preiser et al 1988). Behavioral elements deal with the perceptions and psychological needs of the users and how they interact with the physical settings, as there is undoubtedly an association between the performance and behavior of organization's users, and the effectiveness of the building which they occupy. Physical environmental behavioral attributes are directly related to the learning activities students engage in at school. For example, student may require working in a group or conducting independent study. The quality of the behavioral elements will be the main influential factor regarding whether the physical environment enhance such activities or hindering them. It also includes attributes that would foster the relationship between the building and the occupant such as sense of belonging and ownership.

The main attributes of behavioral performance that will be investigated in this thesis include the following:

- Territoriality
- Proximity
- Privacy
- Social Interaction
- Environmental perception
- Way finding
- Sense of belonging
- Stimulating Environment
- Aesthetic quality

## 4.2 The Status of the Public Schools Facilities in Saudi Arabia: Assessment Framework and Data Analysis

The initiatives to improve the state of education in Saudi Arabia have led to adaptation of new educational strategies that involves implementing a new set of goals and objectives. Public school facilities have been given special attention in these processes toward reforming the whole educational system. The development of school buildings is one of the main objectives of the "Deputy Ministry for Buildings and School Equipments". The work duties of the Deputy include the architectural and functional aspects of the building and its components (DMBSE, re: 2008). Although many school buildings have been designed and constructed recently, serious concern is growing due to the signs indicating that too many of the mistakes of the past look like being repeated in the new school buildings constructed under the "National Plan of School Buildings". Of course –and it must be –the aim of such project is not to replace crumpling building with new one, it is to provide a responsive physical environment within which the government's ambitious transformation can be achieved.

The results collected from the representative sample of school buildings selected for the purposes of this study assured the alert signs of repeating many of the past mistakes in the new school buildings. Although the assessment process involved only a few school facilities, a clear statement about the current models of school building can be reached.

### 4.2.1 Assessment Procedures

The assessment process involved four high-schools located in Dammam Metropolitan Area: al-Dammam city, al-Khobar city and al-Dhahran city. The four schools are: al-Khaleej School (in Dammam), al-Kesaea School (in Khobar), al-Jeser

School (in Dhahran) and Prince Mohammad bin Fahad School (in Dammam). The selection of the four schools was reached by the assistance of the senior architectural engineer and the deputy manger of the administration of building affairs, General Administration of education, Eastern Province). The two first schools have the same prototype design. This prototype has been the most popular constructed school model during the last years, and the one most likely to be selected to build most of the new schools. This is because of the simplicity of its design and due to economical considerations since it is less expensive than the other models.

The others two types representing two different models that are considered as more mature prototypes (as thought by the Ministry), but they are not constructed widely due to demographic and economical considerations. The aim of selecting these two prototypes is to ensure that: (1) the study covers variety of existing school models, (2) investigate some existing models that are thought to be capable to accommodate the requirements of the transformation era. The assessment process was planned to be conducted in three phases, they were as follow:

- **Phase One:** Visiting the four schools and conducting personal interviews with key administrative staff (school rector or vices rector). The phase was planned to be an introductory stage where the researcher got familiar to the schools, and had insight into the actual daily operation of each school.

- **Phase Two**: conducting a workshop session with the actual users of the school; teachers and students. The workshop session composed of several activities illustrated below. For the purpose of this phase, twelve teachers and twelve students from each school were planned to participate in the process of the assessment. The workshop day for each group (faculty and students) were planned to be conducted separately. This was thought to provide less formal gathering and to allow better management of the workshop activities. The workshops were planned to be composed of the following activities.

- Introducing the study to the participants (faculty and students separately) and running a presentation explaining the procedure and the activities required from each group; faculty and students.

- **Faculty session**; structured into five main parts as follows:

- **Part one**: Reviewing learning strategies, teaching methods and approaches (learning modalities). The aim of this phase is to have a general and comprehensive review of the ways by which teaching and learning are taken place. A handout was prepared by the researcher for this phase which contained 18 learning modalities (the details of these modalities are provided in Appendix-C). For each modality a brief description, and intended educational outcomes, and learning activities were identified. The content of the handout was obtained from several educational sources from both national and global literatures. Learning activities were a key element given more attention as they became the base for further work. This phase was planned to be conducted in workshop format. So that the faculty was divided into four groups each consisted of three members. Working in small groups was intended to encourage all participants to have a voice in the process. In addition, working collaboratively in small group was thought as an opportunity for faculty to learn from each others. The faculty was giving the freedom to add any approach or activities thought are beneficial for learning process.

- **Part Two**: Evaluating the performance of the school building in terms of their capability to facilitate the intended activities identified in the former phases. The way in which the survey was structured is based in two main factors. The first is dividing the survey into 19 titles (later condensed into 15) based on the proposed activity settings, school facility should have in order to facilitate the accomplish the learning activities and achieve the desired objectives (more details are provided about the development of the

activity settings under chapter four). The second factor considered in developing the survey is the integration between the functional, behavioral and technical elements the make the actual performance of the building in term of the intended use. In addition to the 19 sections, the participants were required to provide their opinions with regards to certain aspects thought they are critical for the success of the school building. The aspects included were safety and security, furniture, esthetics quality and general health considerations. The participants were asked to conduct this phase individually as they are perceived subjectively from person to person. The survey was design to be answered based on four rating scale: Very Satisfied, Satisfied, Not Satisfied, and strongly not Satisfied. The four rating scale was intended to avoid having a neutral answer which is very common especially when the targeted audiences are expected to be not fully aware about the subject under concern. Also, the scale was made relatively small in order not to confuse to the participants as they are not experts, and to assure maintaining interest over the whole activities of the session. In addition to giving the satisfaction level for each identified criteria in the survey, the participants were asked to give the absolute level of importance for each criteria in relation to the school facilities in general, not in relation to their school in particular. Four levels of importance were identified: Very Important, Important, Somewhat Important, and Not Important. Similar considerations were given to the design of the importance levels as the design of the satisfaction levels.

- **Part three**: Running presentation about new trends in design school facilities. As part of the workshop activities, a visual presentation was planned to be delivered to the participants. The aim of the presentation was not intended to provide solutions to the potential problems; it was aimed to expose participants to the latest practice of design school facility. Examples of exiting school facilities having radical design approach than what is common (factory-model school) were incorporated to the presentation. This

phase was very important for the following phase (guidelines for future school), as most of the participants (faculty and students) are not aware of the global development in the recent practice of designing school.

- **Part Four**: Discussing main headings intended to improve the performance of current and future school buildings. For this stage, a handout was prepared by the researcher containing main headings categorized based in the structure used for developing the survey. Under each heading, a set of physical characteristics for the intended learning activity setting were suggested. Following the same structure for activity two and four was intended to facilitate the process of benefiting from the obtained data for feedback to the existing stock of school buildings and feedforward for next and future school projects. The plan was for participants to work in small groups as in activity two. Also, the participants were given the freedom to discus, modify, edit, and provide any suggestions thought to be useful for school performance.

- **Part Five**: Determining the relationship level between the identified learning modalities and the proposed physical spaces; activity settings. This phase was planned to be the last activity conducted in the workshop session. It was planned to be as a general summary for the assessment process by which the importance of each proposed activity setting is identified for each learning modalities. Consequently, the overall importance of each activity setting in relation to the whole school facility can be obtained. To complete the requirements of this phase, the task was planned to be conducted in small group similar to the procedure followed in activities two and four.

- **Students' session**: designed in similar way to the teachers' session except for part one and five. In part one, a presentation was planned to be delivered to the participated students. The presentation addressed the subject of the learning modalities and the roll of students in the learning

process. An open discussion was planned to be held at the end of part one. Part five of the workshop activities was not planned to be conducted in students' session.

- **Phase Three**: Conducting an expert inspection and evaluation of the performance of the four schools. For the purpose of this phase an audit form was prepared by the researcher. The audit form was structure in the same way as the satisfaction survey. This was to assure consistency among the different methods used to obtain the data about the performance of schools. The aim of the audit was to describe the capability of school facilities to cope with the requirements of the proposed activity settings from an expert prospective. For this reason, the rating scale used for the audit was greater than the satisfaction survey, and was consisted of six scales. The six scales – with their corresponding values were: Extremely Capable (5), Capable (4), Somewhat Capable (3), Somewhat Incapable (2), Incapable (1), and Extremely Incapable (0).

### 4.2.2 The Assessment Process in the Field: Hopes and Difficulties

The ambitious aim of the participatory approach adapted to conduct main parts of this thesis was to involve participants (teachers and students) in making actual physical design based on their priorities. Due to several reasons, participants' role did not meet this hope, and was limited to what Jim Burns (1979) described as awareness and perception level. At awareness level, participants rediscover the realities of a given environment. While at Perception level, participants go from awareness of the situation to understanding it and its physical, social and cultural implications. It means sharing with each other so that understanding, objectives, and expectations of all participants become recourses for planning and not hidden agendas that could disrupt the project later on. Some of the main reasons include:

- Limited research resources. The research is conducted by an individual based with limited economical and technical resources.

- Time constrains. The research is conducted in fulfilling the requirements of Master degree which must be completed within certain time.

- Lack of general awareness about education. In most of the visited schools, there is a clear lack of awareness about the development in educational profession, the new pedagogy methods and learning styles. The lack was observed not only on the students, unfortunately, it included even the teachers.

- Lack of actual appreciation of the role of the physical environment. Even at the top administration level of education, the physical environment is still being perceived as second priority. Although, the debate about school building is one of the hottest subjects in the society, the greatest hope and the maximum effort are toward providing standard (factory-model) public school facilities.

- Limited resources within the school facility. In all of the four schools, in the best case, there was only one place that was to some degree suitable to conduct the workshop. In some cases, even the basic requirements were not well prepared.

- A common pessimist belief within most of the participants. Most of the participants strongly believe that whatever they do will not be taken seriously by the decision makers. This generally has led to the loss of trust between the schools' clients and schools owner.

### 4.2.3 The Results of the Assessment Process

For all the four schools, the performance of the school is calculated as the average of three components; the students' survey, the teachers' survey and the expert inspection audit. The final result from the students' survey is the average score of all students participated in the assessment process. Similarly, the finale score obtained from the teachers' survey is the average score for all teachers who participated in the process. Regarding the expert survey, it had only one value as it was done by one person. Each one of the three components makes one third of the final score the school obtained. A similar thing was done with regard to the level of importance for each identified activity setting. Hover, the expert (the researcher) did not provided importance level, for subjectivity reason.

The ability of the school to support any intended activity setting is described as follow.

| | | | | | |
|---|---|---|---|---|---|
| **Poor** | 0 | ≤ | Average Score | < | 1 |
| **Mediocre** | 1 | ≤ | Average Score | < | 1.5 |
| **Partial good** | 1.5 | ≤ | Average Score | < | 2 |
| **Good** | 2 | ≤ | Average Score | < | 2.5 |
| **Excellent** | 2.5 | ≤ | Average Score | < | 3 |

#### 4.2.3.1 First Prototype School Building: al-Khaleej High-School, Dammam, and *al-Kesaea* High-School, Khobar

Although both schools (Figure 4.3, 4.4) have the same design and main infrastructure, variation in the obtained results can be noticed, especially with regards to students' response. While none of the two schools obtained "Partial good" capability level ($1.5 \leq$ Average Score $< 2$, out of 3) less to accommodate any of the 15 identified activity settings – which is very bad- al-Kesaea school achieved slightly high scores than al-Khaleej school. This discrepancy can be trace to contextual issues related to the location of the two schools. Al-Khaleej school has typical public school location where the boundary of the serviced community (or geographical district boundary) is not clear. However, al-Kesaea school is located within the boundary of enclosed high population community (*Esskan al-Khobar*). As a result, most of the students who joined the school are living within this area. This was expected to enhance the social norm within the school overall environment, which had a positive impact in the assessment comparing to the analog school. Table 4.1and 4.2 present the importance level and the obtained score for each identified activity setting.

***Figure 4.3**: First Prototype School Model, Ground Floor Plan, al- Khaleej and al-Kesaea High-Schools*

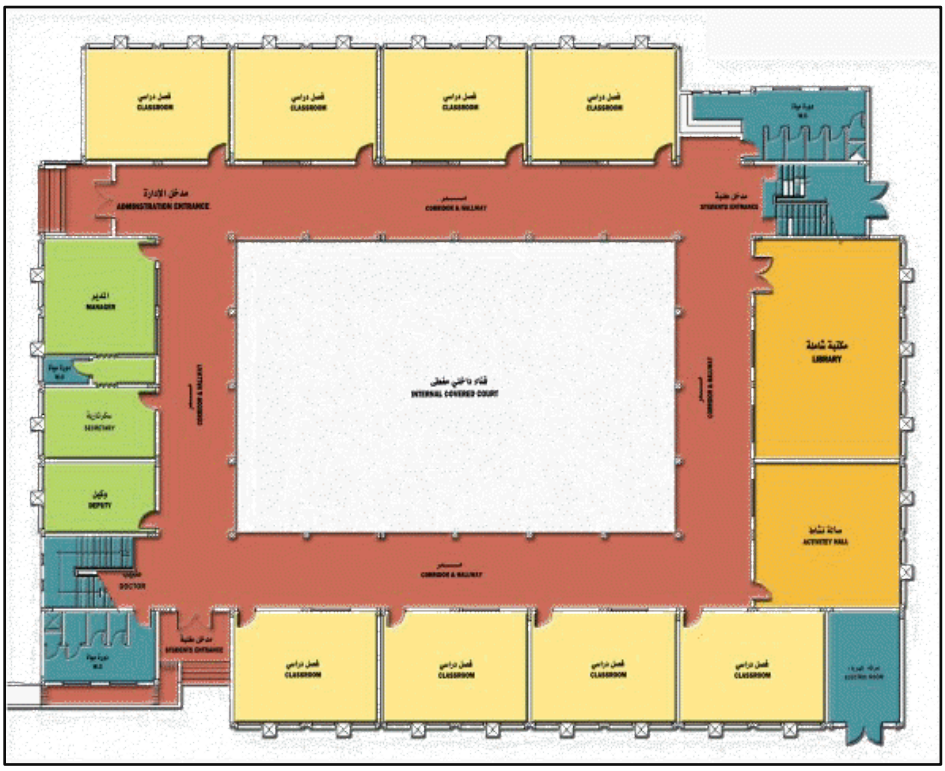



***Figure 4.4**: First Prototype School Models, 3D Image, al- Khaleej and al- Kesaea High-Schools*

***Table 4.1:*** *Summary of the Result for al-Khaleej High-School (Students, Teachers and Expert Evaluation Results)*

| **Intended Physical Setting** | | **Al-Khaleej School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **TEA** | **EXP** | **AVR** |
| 1 | Teachers Workplace Activity Setting | Imp. | | 2.33 | | **2.33** |
| | | S. | | 1.07 | 0.45 | **0.76** |
| 2 | Collective Teaching (lecture) Activity Setting | Imp. | 2.61 | 2.33 | | **2.47** |
| | | S. | 1.25 | 0.83 | 1.46 | **1.18** |
| 3 | Student Individual-Work Activity Setting | Imp. | 2.39 | 2.33 | | **2.36** |
| | | S. | 1.00 | 0.56 | 0.08 | **0.55** |
| 4 | Students Collaborative-Work Activity Setting | Imp. | 2.58 | 2.33 | | **2.46** |
| | | S. | 0.63 | 0.67 | 0.40 | **0.56** |
| 5 | Discussion and Presentation Activity Setting | Imp. | 2.45 | 2.33 | | **2.39** |
| | | S. | 1.25 | 0.93 | 0.85 | **1.01** |
| 6 | Collecting Data and Information Activity Setting | Imp. | 2.53 | 2.33 | | **2.43** |
| | | S. | 0.98 | 1.20 | 0.75 | **0.98** |
| 7 | Scientific Experiments and Hands-On Activity Setting | Imp. | 2.62 | 2.33 | | **2.48** |
| | | S. | 0.54 | 0.92 | 0.37 | **0.61** |
| 8 | Creative and Conceiving Activity Setting | Imp. | 2.83 | 2.33 | | **2.58** |
| | | S. | 0.33 | 0.00 | 0.30 | **0.21** |
| 9 | Technology-Based Activity Setting | Imp. | 2.71 | 2.17 | | **2.44** |
| | | S. | 0.20 | 0.58 | 0.34 | **0.38** |
| 10 | Social Activity Setting | Imp. | 2.68 | 2.33 | | **2.51** |
| | | S. | 0.48 | 0.56 | 0.07 | **0.37** |
| 11 | Flexible Activities Learning Setting | Imp. | 2.48 | 2.33 | | **2.41** |
| | | S. | 0.90 | 0.08 | 0.40 | **0.46** |
| 12 | Community Related Learning Setting | Imp. | 2.61 | 2.67 | | **2.64** |
| | | S. | 0.64 | 0.22 | 0.53 | **0.46** |
| 13 | Orderly-Configured Learning Setting | Imp. | 2.25 | 2.33 | | **2.29** |
| | | S. | 0.82 | 0.40 | 0.17 | **0.46** |
| 14 | Effective Circulation: Dynamic Learning Setting | Imp. | 2.39 | 2.33 | | **2.36** |
| | | S. | 1.31 | 1.17 | 0.64 | **1.04** |
| 15 | High-Operational Performance Learning Setting | Imp. | 2.88 | 2.33 | | **2.61** |
| | | S. | 1.08 | 1.29 | 0.86 | **1.08** |
| | **Overall School Facility** | **Imp.** | **2.57** | **2.34** | | **2.46** |
| | | **S.** | **0.82** | **0.70** | **0.51** | **0.68** |

***Table 4.2:*** *Summary of the Result for al-Khaleej High-School (Students, Teachers and Expert Evaluation Results)*

| Intended Physical Setting | | Al-Kesaea School | | | | |
|---|---|---|---|---|---|---|
| | | | STU | TEA | EXP | AVR |
| 1 | Teachers Workplace Activity Setting | Imp. | | 2.65 | | **2.65** |
| | | S. | | 1.11 | 0.45 | **0.78** |
| 2 | Collective Teaching (lecture) Activity Setting | Imp. | 2.10 | 2.90 | | **2.50** |
| | | S. | 1.43 | 1.54 | 1.46 | **1.48** |
| 3 | Student Individual-Work Activity Setting | Imp. | 2.29 | 2.77 | | **2.53** |
| | | S. | 1.48 | 1.13 | 0.08 | **0.90** |
| 4 | Students Collaborative-Work Activity Setting | Imp. | 2.21 | 2.75 | | **2.48** |
| | | S. | 1.43 | 1.25 | 0.40 | **1.03** |
| 5 | Discussion and Presentation Activity Setting | Imp. | 2.31 | 2.72 | | **2.52** |
| | | S. | 1.49 | 1.29 | 0.85 | **1.21** |
| 6 | Collecting Data and Information Activity Setting | Imp. | 2.31 | 2.72 | | **2.52** |
| | | S. | 1.94 | 1.17 | 0.75 | **1.29** |
| 7 | Scientific Experiments and Hands-On Activity Setting | Imp. | 2.43 | 2.79 | | **2.61** |
| | | S. | 1.29 | 1.00 | 0.37 | **0.89** |
| 8 | Creative and Conceiving Activity Setting | Imp. | 2.14 | 2.54 | | **2.34** |
| | | S. | 1.43 | 0.92 | 0.30 | **0.88** |
| 9 | Technology-Based Activity Setting | Imp. | 2.25 | 2.77 | | **2.51** |
| | | S. | 1.29 | 0.75 | 0.34 | **0.79** |
| 10 | Social Activity Setting | Imp. | 2.14 | 2.65 | | **2.40** |
| | | S. | 1.40 | 0.86 | 0.07 | **0.78** |
| 11 | Flexible Activities Learning Setting | Imp. | 2.39 | 2.63 | | **2.51** |
| | | S. | 1.63 | 1.04 | 0.40 | **1.02** |
| 12 | Community Related Learning Setting | Imp. | 2.33 | 2.67 | | **2.50** |
| | | S. | 2.19 | 0.90 | 0.34 | **1.14** |
| 13 | Orderly-Configured Learning Setting | Imp. | 2.20 | 2.48 | | **2.34** |
| | | S. | 1.57 | 1.06 | 0.17 | **0.93** |
| 14 | Effective Circulation: Dynamic Learning Setting | Imp. | 2.39 | 2.63 | | **2.51** |
| | | S. | 2.18 | 1.14 | 0.68 | **1.33** |
| 15 | High-Operational Performance Learning Setting | Imp. | 2.53 | 1.83 | | **2.18** |
| | | S. | 1.96 | 1.09 | 0.86 | **1.30** |
| | **Overall School Facility** | **Imp.** | **2.29** | **2.63** | | **2.46** |
| | | **S.** | **1.62** | **1.08** | **0.50** | **1.07** |

Regardless of the slight variation in the results, the two schools showed similar results in term of the activity settings. The schools did best, and even did worst, with minor difference (table 4.3, and table 4.4). Both schools did best with regard to "Collective Teaching (lecture) Activity Setting". This ensures that these schools were designed for teacher-centric approach. And even for this purpose they did not perform well (max. score: 1.48; or mediocre level).

***Table 4.3:*** *Best Areas of School Performance, al-Khaleej High-School*

| **Intended Physical Setting** | | **Al-Khaleej School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Collective Teaching (lecture) Activity Setting | Imp. | 2.61 | 2.33 | | **2.47** |
| | | S. | 1.25 | 0.83 | 1.46 | **1.18** |
| 2 | Discussion, Negotiation and Presentation Activity Setting | Imp. | 2.45 | 2.33 | | **2.39** |
| | | S. | 1.25 | 0.93 | 0.85 | **1.01** |
| 3 | Dynamic Activity Setting | Imp. | 2.39 | 2.33 | | **2.36** |
| | | S. | 1.31 | 1.17 | 0.64 | **1.04** |
| 4 | Collecting Data and Information Activity Setting | Imp. | 2.53 | 2.33 | | **2.43** |
| | | S. | 0.98 | 1.20 | 0.75 | **0.98** |

***Table 4.4:*** *Best Areas of School Performance, al-Kesaea High-School*

| **Intended Physical Setting** | | **Al-Kesaea School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Collective Teaching (lecture) Activity Setting | Imp. | 2.10 | 2.90 | | **2.50** |
| | | S. | 1.43 | 1.54 | 1.46 | **1.48** |
| 2 | High-Operational Performance Activity Setting | Imp. | 2.53 | 1.83 | | **2.18** |
| | | S. | 1.96 | 1.09 | 0.86 | **1.30** |
| 3 | Dynamic Activity Setting | Imp. | 2.39 | 2.63 | | **2.51** |
| | | S. | 2.18 | 1.14 | 0.68 | **1.33** |

When it comes to the areas of worst performance, statistics showed that inability to provide spaces to enhance creativity and the use of technology were common features of the physical environment for both schools (table 4.5, and table 4.6). Other areas of worst performance are presented in tables 4.5 and 4.6.

***Table 4.5:*** *Worst Areas of School Performance, al-Khaleej High-School*

| **Intended Physical Setting** | | **Al-Khaleej School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Creative and Conceiving Activity Setting | Imp. | 2.83 | 2.33 | | **2.58** |
| | | S. | 0.33 | 0.00 | 0.30 | **0.21** |
| 2 | Social Activity Setting | Imp. | 2.68 | 2.33 | | **2.51** |
| | | S. | 0.48 | 0.56 | 0.07 | **0.37** |
| 3 | Technology-Based Activity Setting | Imp. | 2.71 | 2.17 | | **2.44** |
| | | S. | 0.20 | 0.58 | 0.34 | **0.38** |

***Table 4.6:*** *Worst Areas of School Performance, al- Kesaea High-School*

| **Intended Physical Setting** | | **Al-Kesaea School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Social Activity Setting | Imp. | 2.14 | 2.65 | | **2.40** |
| | | S. | 1.40 | 0.86 | 0.07 | **0.78** |
| 2 | Technology-Based Activity Setting | Imp. | 2.25 | 2.77 | | **2.51** |
| | | S. | 1.29 | 0.75 | 0.34 | **0.79** |
| 3 | Individual Work Activity Setting | Imp. | 2.29 | 2.77 | | **2.53** |
| | | S. | 1.48 | 1.13 | 0.08 | **0.90** |

The overall performances of the schools –in relation to all intended activity settings –were quite similar. While the first school obtained .068 out of 3 (poor level), the second school obtained 1.01 out of 3 (mediocre level). In other words, both schools have performed unsuccessfully, but school one has poorer performance than school two.

Figure 4.5 and Figure 4.6; summarize the level of importance, the obtained scores and its respective capability's descriptions for all the activity settings of the both schools.

***Figure 4.5**: Summary of the Result for al-Khaleej High-School (Chart Representations of Importance, Score, and Capability's Description)*

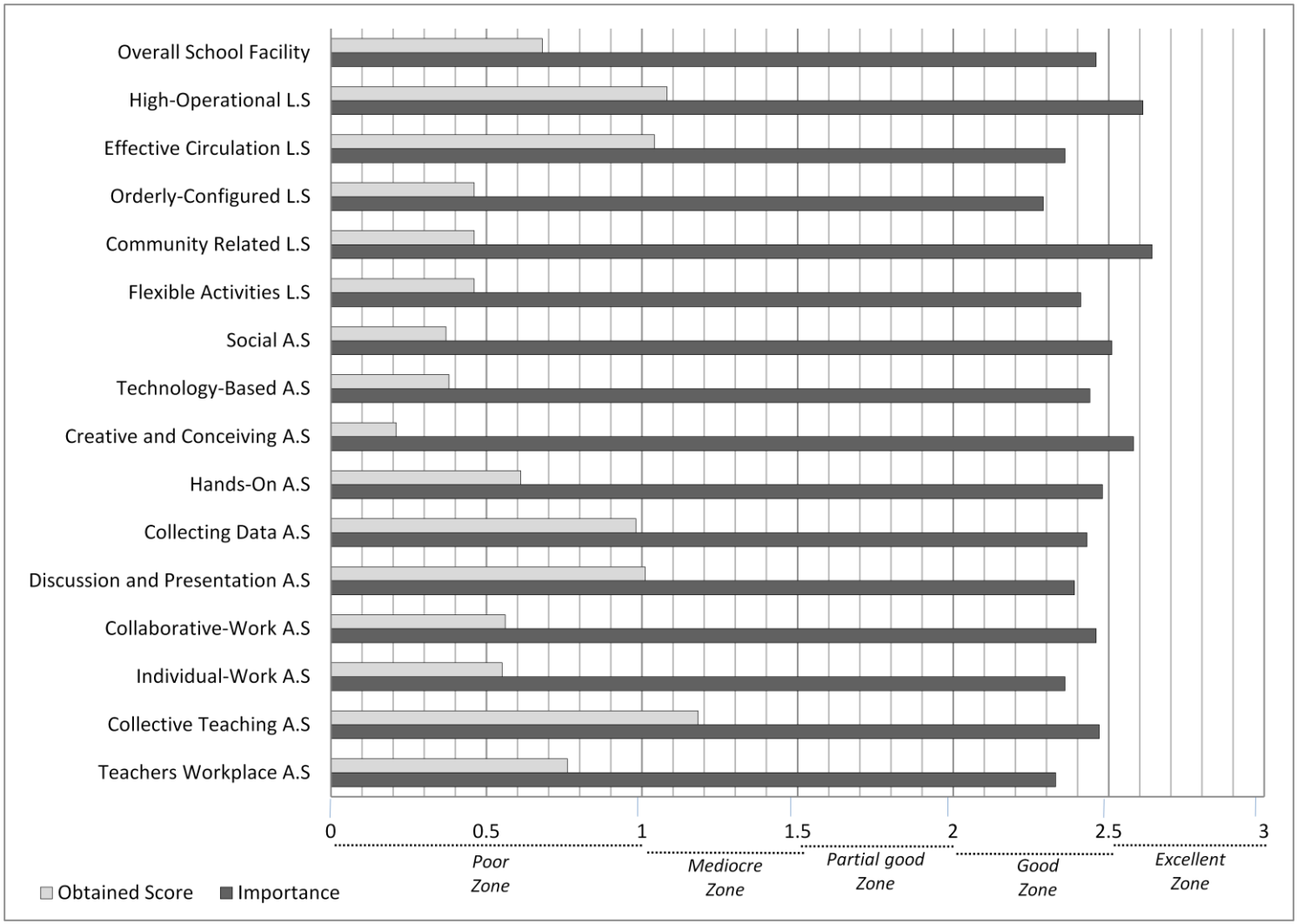
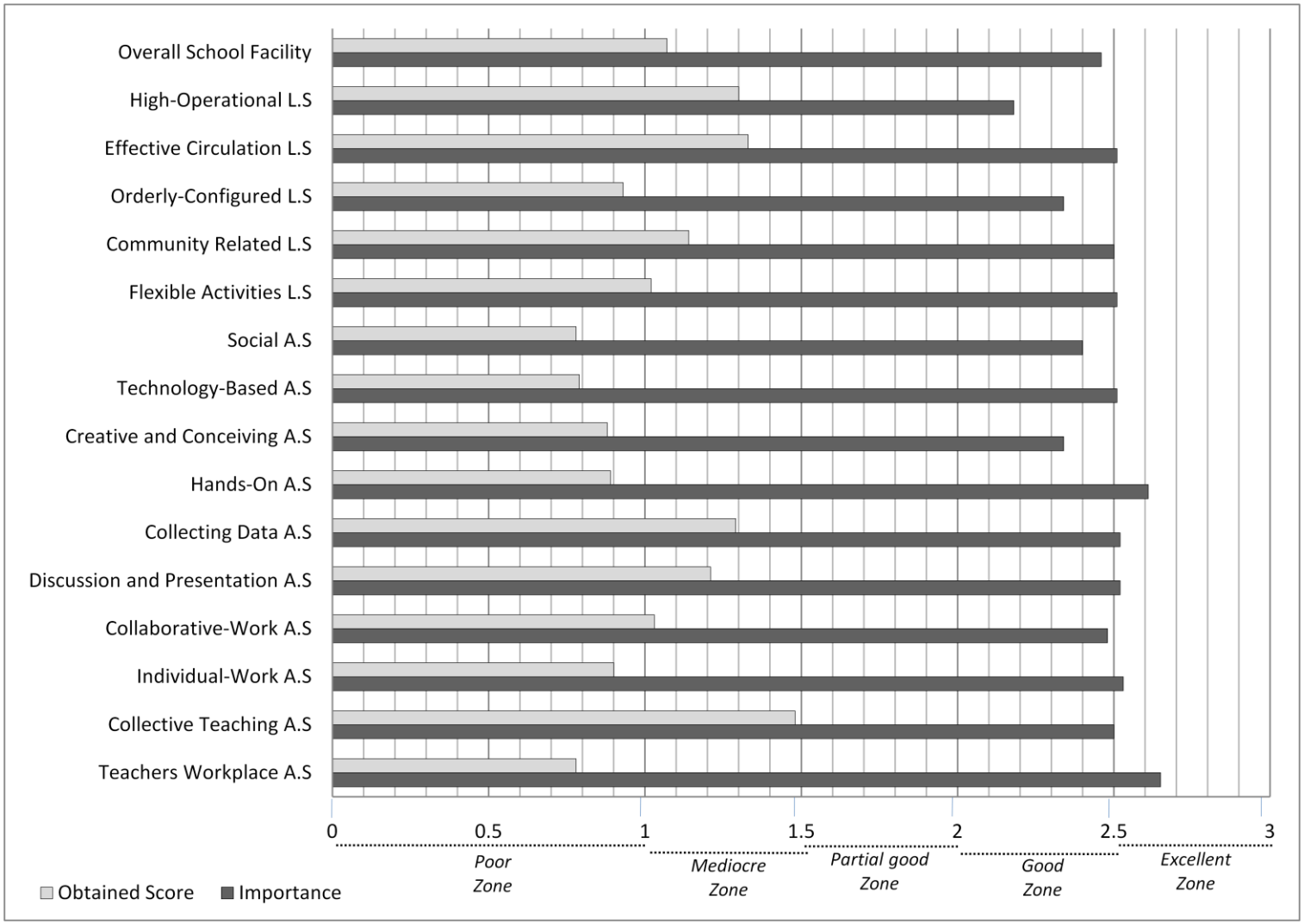


***Figure 4.6**: Summary of the Result for al- Kesaea High-School (Chart Representations of Importance, Score, and Capability's Description)*



#### 4.2.3.2 Second Prototype School Building: al-Jeser High-School, Dhahran

This prototype design is also called "*al-Mujamaa*" (means the Compound, Figure 4.7, 4.8) because it was designed to accommodate three educational levels (elementary, intermediate and secondary) at one building, but with complete separation. From the prospective of the Ministry of education, it is less preferred to construct due to its high initial cost (almost 17 millions SR, as reported by the deputy manager). Despite the high cost, the interview with administrative staff of the school expressed a great complaint about managing the whole facility. This was because of the mix use of the building by different educational levels. On the other hand, the total performance of the building with regard to the identified learning activities settings did not show any great improvement. Moreover, the building came at second worst schools out of the four. The overall score of the building was 0.76 out of 3, which is the lowest capability level used in the study. Table 4.7; presents the importance level and the obtained score for each identified activity setting.

***Figure 4.7**: Second Prototype School Model, Ground Floor Plan, al-Jeser High-School*

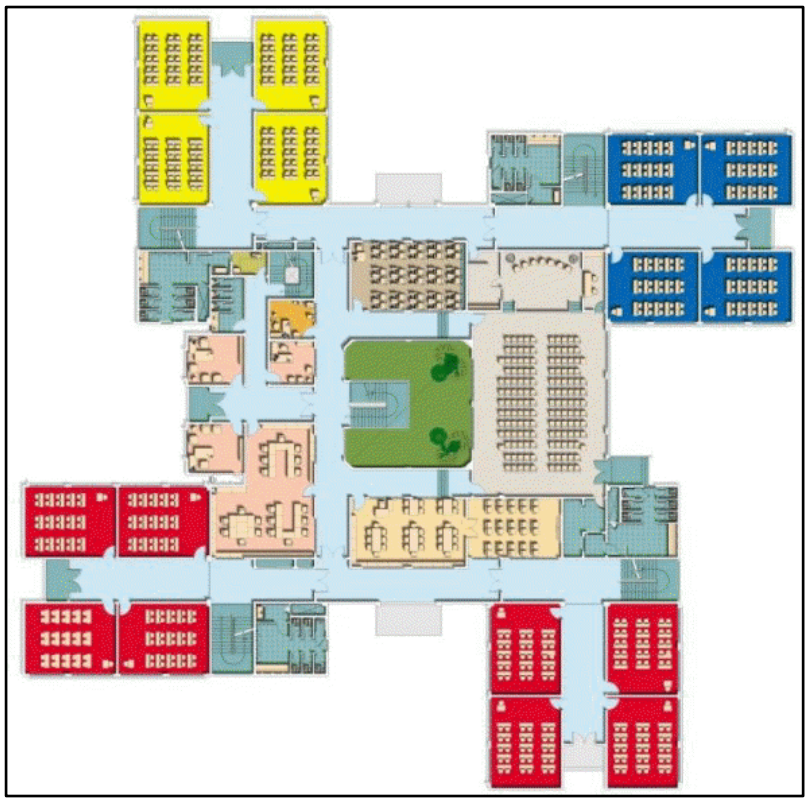


***Figure 4.8**: Second Prototype School Model, 3D Image, al-Jeser High-School*

***Table 4.7:*** *Summary of the Result for al-Jeser High-School (Students, Teachers and Expert Evaluation Results)*

| Intended Physical Setting | | Al-Jeser School | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Teachers Workplace Activity Setting | Imp. | | 2.64 | | **2.64** |
| | | S. | | 0.82 | 0.50 | **0.66** |
| 2 | Collective Teaching (lecture) Activity Setting | Imp. | 2.65 | 2.88 | | **2.76** |
| | | S. | 1.49 | 1.04 | 0.87 | **1.14** |
| 3 | Student Individual-Work Activity Setting | Imp. | 2.63 | 2.38 | | **2.50** |
| | | S. | 0.74 | 0.75 | 0.05 | **0.51** |
| 4 | Students Collaborative-Work Activity Setting | Imp. | 2.32 | 2.44 | | **2.38** |
| | | S. | 1.23 | 0.91 | 0.24 | **0.79** |
| 5 | Discussion and Presentation Activity Setting | Imp. | 2.50 | 2.53 | | **2.51** |
| | | S. | 1.20 | 0.83 | 0.51 | **0.84** |
| 6 | Collecting Data and Information Activity Setting | Imp. | 2.46 | 2.60 | | **2.53** |
| | | S. | 1.00 | 0.73 | 0.39 | **0.70** |
| 7 | Scientific Experiments and Hands-On Activity Setting | Imp. | 2.42 | 2.48 | | **2.45** |
| | | S. | 1.04 | 0.57 | 0.18 | **0.60** |
| 8 | Creative and Conceiving Activity Setting | Imp. | 2.86 | 2.50 | | **2.68** |
| | | S. | 0.63 | 0.50 | 0.18 | **0.44** |
| 9 | Technology-Based Activity Setting | Imp. | 2.57 | 2.75 | | **2.66** |
| | | S. | 0.88 | 0.31 | 0.21 | **0.46** |
| 10 | Social Activity Setting | Imp. | 2.30 | 2.48 | | **2.39** |
| | | S. | 1.00 | 1.34 | 0.25 | **0.86** |
| 11 | Flexible Activities Learning Setting | Imp. | 2.39 | 2.53 | | **2.46** |
| | | S. | 1.19 | 0.81 | 0.61 | **0.87** |
| 12 | Community Related Learning Setting | Imp. | 2.33 | 2.29 | | **2.31** |
| | | S. | 0.90 | 0.79 | 0.52 | **0.74** |
| 13 | Orderly-Configured Learning Setting | Imp. | 2.11 | 2.48 | | **2.29** |
| | | S. | 1.29 | 0.83 | 0.31 | **0.81** |
| 14 | Effective Circulation: Dynamic Learning Setting | Imp. | 2.43 | 2.70 | | **2.57** |
| | | S. | 1.18 | 0.94 | 0.23 | **0.78** |
| 15 | High-Operational Performance Learning Setting | Imp. | 2.59 | 2.82 | | **2.71** |
| | | S. | 1.46 | 1.32 | 0.59 | **1.12** |
| | **Overall School Facility** | Imp. | **2.47** | **2.57** | | **2.52** |
| | | S. | **1.09** | **0.83** | **0.38** | **0.76** |

In more details, the statistics showed that the building has even shared some of the characteristics of the former two schools building in term of the areas of best and worst performances (Tables 4.8 and 4.9). In term of best areas of performance; although the building was looked different at the beginning, still lecture format activity setting was the dominant feature of the school. The "Collective Teaching (lecture) Activity Setting" scored the best with 1.14 out of 3, but it had been still remaining within the "Mediocre" level of capability. The building also shared the second top area of performance with al-Kesaea school, which was the environmental systems performance.

***Table 4.8:*** *Best Areas of School Performance, al- Jeser High-School*

| **Intended Physical Setting** | | **Al-Jeser School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Collective Teaching (lecture) Activity Setting | Imp. | 2.65 | 2.88 | | **2.76** |
| | | S. | 1.49 | 1.04 | 0.87 | **1.14** |
| 2 | High-Operational Performance Activity Setting | Imp. | 2.59 | 2.82 | | **2.71** |
| | | S. | 1.46 | 1.32 | 0.59 | **1.12** |
| 3 | Divers Activities Activity Setting | Imp. | 2.39 | 2.53 | | **2.46** |
| | | S. | 1.19 | 0.81 | 0.61 | **0.87** |

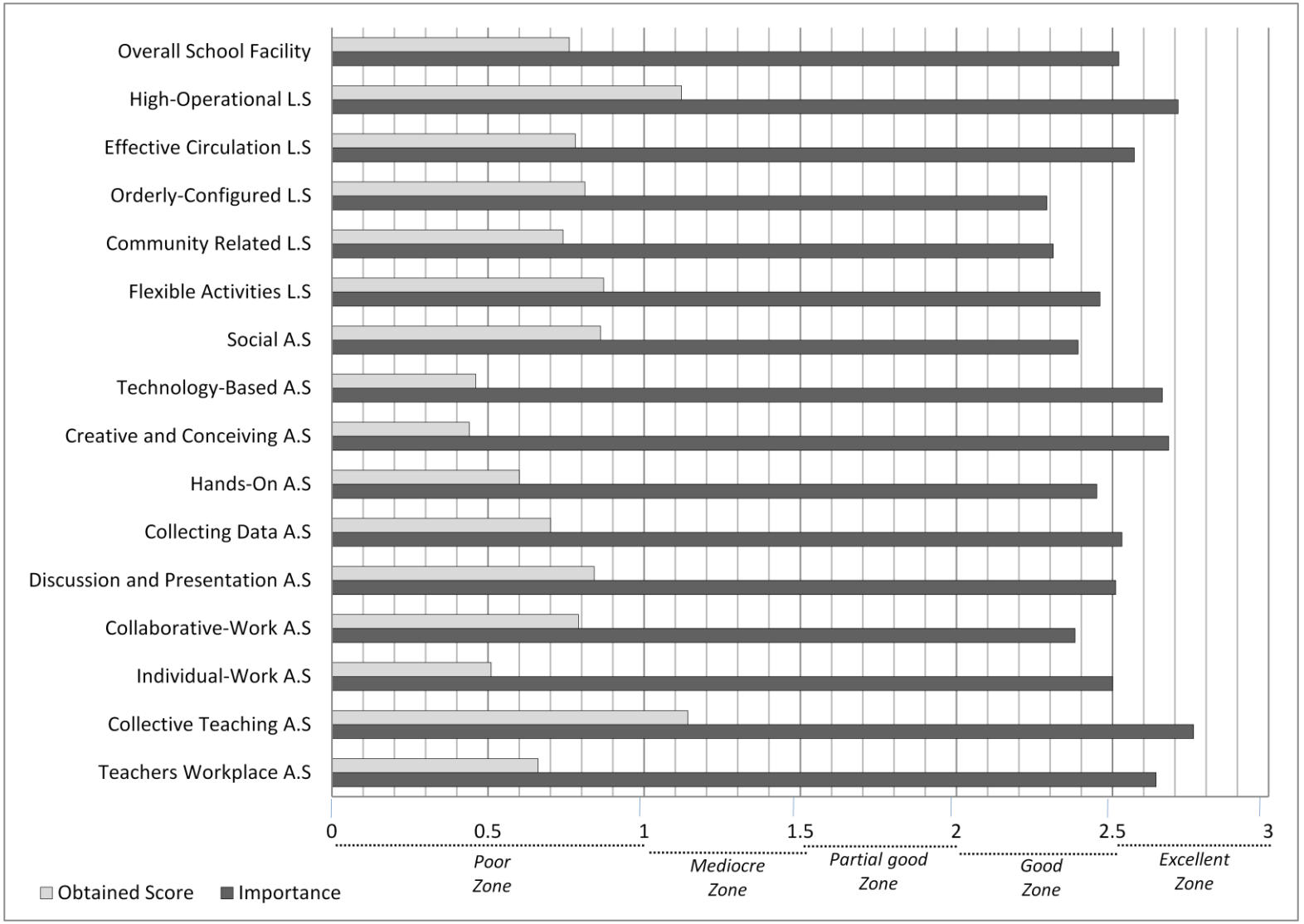
The obtained results also showed that the building did not perform better regarding the aspects considered as weak points on the pervious schools. Social activity setting, technology-based setting, and individual work activity setting all remained the worst areas of building performance.

***Table 4.9:*** *Worst Areas of School Performance, al- Jeser High-School*

| Intended Physical Setting | | Al- Jeser School | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Social Activity Setting | Imp. | 2.14 | 2.65 | | **2.40** |
| | | S. | 1.40 | 0.86 | 0.07 | **0.78** |
| 2 | Technology-Based Activity Setting | Imp. | 2.25 | 2.77 | | **2.51** |
| | | S. | 1.29 | 0.75 | 0.34 | **0.79** |
| 3 | Individual Work Activity Setting | Imp. | 2.29 | 2.77 | | **2.53** |
| | | S. | 1.48 | 1.13 | 0.08 | **0.90** |

Figure 4.9; summarizes the level of importance, the obtained scores and its respective capability's descriptions for all the activity settings of the school.

***Figure 4.9**: Summary of the Result for al- Jeser High-School (Chart Representations of Importance, Score, and Capability's Description)*



#### 4.2.3.3 Third Prototype School Building: Prince Mohammad Bin High-School School, Dammam

This prototype design is considered as one of the largest school buildings when the foot print of the building is considered (Figures 4.10 and 4.11). The design does not allow shared use by different educational levels as the case in the second prototype (al-Jeser School). In terms of overall school building performance, the school came second after al-Kesaea school, with a 0.91 score (poor level of capabilities). It is important to notice that if we excluded the students' component of the assessment, this model will get the beast score among the four schools. This issue is mentioned here because the matter of social norm discussed under al-Kesaea School was expected to have a great impact. Table 4.10 summarizes the result of this prototype.

***Figure 4.10**: Third Prototype School Model, Ground Floor Plan, Prince Mohammad Bin Fahad*

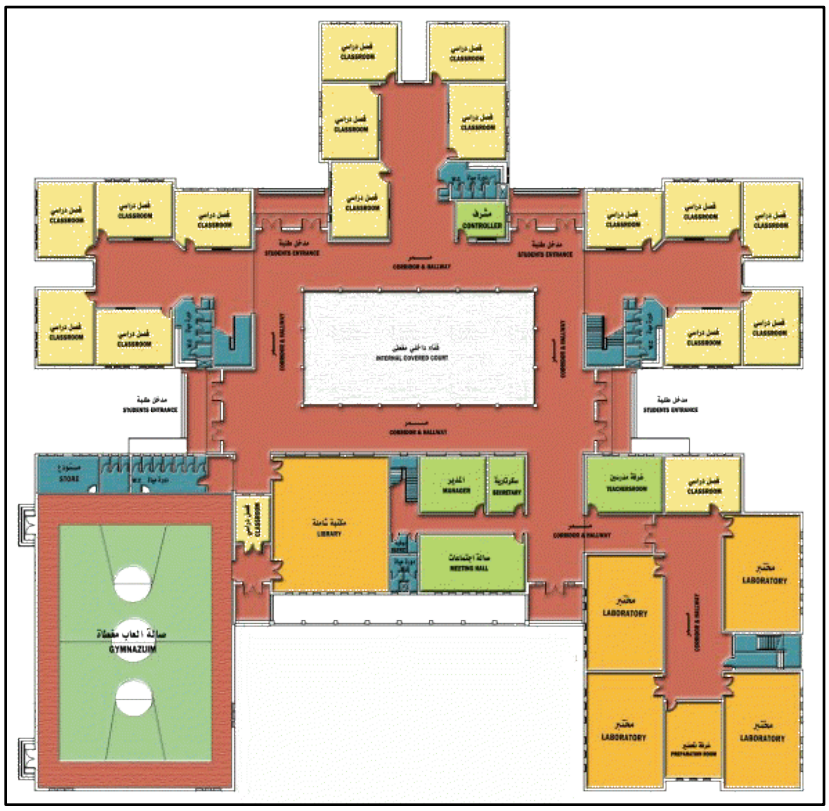



***Figure 4.11**: Third Prototype School Model, 3D Image, al-Jeser High-School*

***Table 4.10:*** *Summary of the Result for P. Mohammad High-School (Students, Teachers and Expert Evaluation Results)*

| Intended Physical Setting | | P. Mohammad School | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Teachers Workplace Activity Setting | Imp. | | 2.80 | | **2.80** |
| | | S. | | 1.33 | 0.50 | **0.92** |
| 2 | Collective Teaching (lecture) Activity Setting | Imp. | 2.63 | 2.90 | | **2.77** |
| | | S. | 1.70 | 1.72 | 0.87 | **1.43** |
| 3 | Student Individual-Work Activity Setting | Imp. | 2.52 | 2.38 | | **2.45** |
| | | S. | 1.33 | 1.43 | 0.05 | **0.94** |
| 4 | Students Collaborative-Work Activity Setting | Imp. | 2.14 | 2.79 | | **2.46** |
| | | S. | 1.31 | 0.68 | 0.36 | **0.78** |
| 5 | Discussion and Presentation Activity Setting | Imp. | 2.53 | 2.86 | | **2.70** |
| | | S. | 1.36 | 1.27 | 0.51 | **1.04** |
| 6 | Collecting Data and Information Activity Setting | Imp. | 2.53 | 2.94 | | **2.74** |
| | | S. | 1.24 | 0.93 | 0.68 | **0.95** |
| 7 | Scientific Experiments and Hands-On Activity Setting | Imp. | 2.42 | 2.95 | | **2.68** |
| | | S. | 1.00 | 0.91 | 0.22 | **0.71** |
| 8 | Creative and Conceiving Activity Setting | Imp. | 2.67 | 3.00 | | **2.83** |
| | | S. | 1.78 | 1.29 | 0.23 | **1.10** |
| 9 | Technology-Based Activity Setting | Imp. | 2.47 | 2.93 | | **2.70** |
| | | S. | 0.88 | 0.54 | 0.21 | **0.54** |
| 10 | Social Activity Setting | Imp. | 2.54 | 2.69 | | **2.61** |
| | | S. | 0.81 | 0.94 | 0.22 | **0.66** |
| 11 | Flexible Activities Learning Setting | Imp. | 2.43 | 2.79 | | **2.61** |
| | | S. | 0.98 | 1.04 | 0.68 | **0.90** |
| 12 | Community Related Learning Setting | Imp. | 2.67 | 2.81 | | **2.74** |
| | | S. | 1.08 | 0.95 | 0.48 | **0.84** |
| 13 | Orderly-Configured Learning Setting | Imp. | 2.67 | 2.63 | | **2.65** |
| | | S. | 1.27 | 0.94 | 0.57 | **0.92** |
| 14 | Effective Circulation: Dynamic Learning Setting | Imp. | 2.57 | 2.84 | | **2.70** |
| | | S. | 1.14 | 1.07 | 0.49 | **0.90** |
| 15 | High-Operational Performance Learning Setting | Imp. | 2.27 | 2.96 | | **2.61** |
| | | S. | 1.17 | 1.06 | 0.69 | **0.98** |
| | **Overall School Facility** | Imp. | 2.50 | 2.82 | | **2.66** |
| | | S. | 1.22 | 1.07 | 0.45 | **0.91** |

Collective teaching or lecture format setting was again the best area of strength, but it is within "Mediocre" level of capability (Table 4.11). What was new is the show up of the teacher workplace as the third best area of performance with score of 0.92 out of 3. The issues related to the performance of building systems kept its position within the most satisfactory elements in the building.

***Table 4.11:*** *Best Areas of School Performance, P. Mohammad High-School*

| **Intended Physical Setting** | | **P. Mohammad School** | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Collective Teaching (lecture) Activity Setting | Imp. | 2.63 | 2.90 | | **2.77** |
| | | S. | 1.70 | 1.72 | 0.87 | **1.43** |
| 2 | High-Operational Performance Activity Setting | Imp. | 2.27 | 2.96 | | **2.61** |
| | | S. | 1.17 | 1.06 | 0.69 | **0.98** |
| 3 | Teachers Workplace Activity Setting | Imp. | | 2.80 | | **2.80** |
| | | S. | | 1.33 | 0.50 | **0.92** |

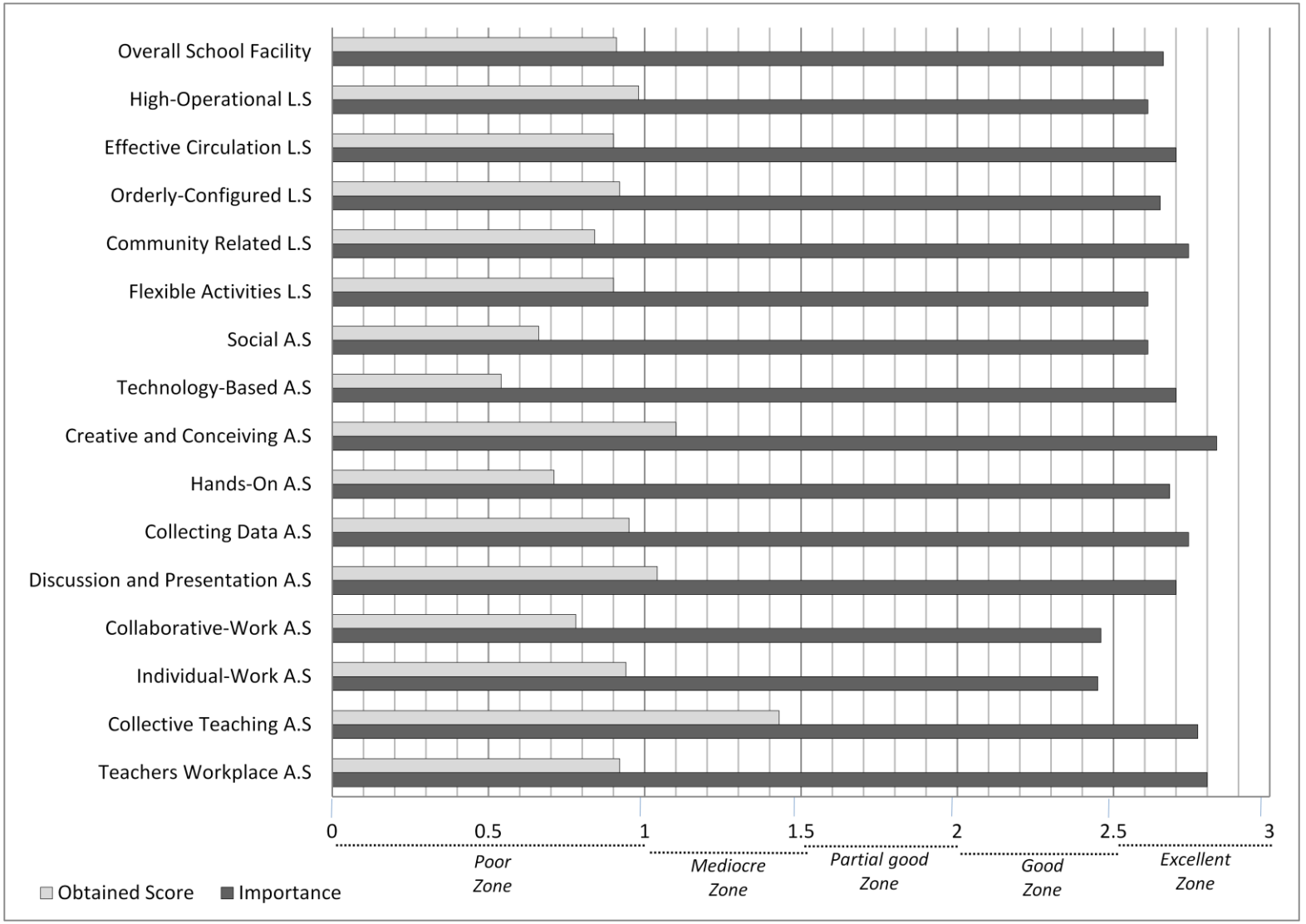
On the other hand, worst areas of performance (Table 4.11) did not show a big difference. While the hand-work activity setting was the new issue that came third, technology and social activities aspects remained some of the main areas in the worst list. Technology came first in this list with score of 0.54 out of 3, which IS considered poor.

***Table 4.12:*** *Worst Areas of School Performance, P. Mohammad High-School*

| Intended Physical Setting | | P. Mohammad School | | | | |
|---|---|---|---|---|---|---|
| | | | **STU** | **FAC** | **EXP** | **AVR** |
| 1 | Technology-Based Activity Setting | Imp. | 2.47 | 2.93 | | **2.70** |
| | | S. | 0.88 | 0.54 | 0.21 | **0.54** |
| 2 | Social Activity Setting | Imp. | 2.54 | 2.69 | | **2.61** |
| | | S. | 0.81 | 0.94 | 0.22 | **0.66** |
| 3 | Hands-Work Activity Setting(s) | Imp. | 2.42 | 2.95 | | **2.68** |
| | | S. | 1.00 | 0.91 | 0.22 | **0.71** |

Figure 4.12; summarizes the level of importance, the obtained scores and its respective capability's descriptions for all the activity settings of the school.

***Figure 4.12**: Summary of the Result for P. Mohammad High-School (Chart Representations of Importance, Score, and Capability's Description)*



#### 4.2.3.4 The Overall Prototype School Building: The Conventional High-School Model

Reviewing the results obtained from the assessment of the four schools indicated clearly that there is a problem with the existing models of school buildings. Although –as the researcher believes –the participants in general do not have enough background about some of the main issues related to schooling, in addition to the limited exposure to other learning environments for most of the participants, there is a great appreciation for the issue identified in the study. On the other hand, the results showed a great dissatisfaction with current situation of school buildings. Out of 3, all the proposed physical settings obtained an importance score above 2. The minimum overall importance score given by the participant was 2.39 for the configuration of the spaces of the school. And the most important aspect –as determined by the participants (teachers and students) was 2.62 for the collective teaching activity settings. Although selecting the lecture format ensured the comment mentioned before about participants' background, this does not means the other issues were not important. Table 4.13 indicates that the difference between the most important activity setting and the least important activity setting was only 0.32 point.

***Table 4.13:*** *Ranking of Activity Settings by Importance (given by faculty and students)*

| | Intended Physical Setting | Overall Importance |
|---|---|---|
| 1 | Collective Teaching (lecture) Activity Setting | 2.62 |
| 2 | Creative and Conceiving Activity Setting | 2.61 |
| 3 | Teachers Workplace Activity Setting | 2.61 |
| 4 | Technology-Based Activity Setting | 2.58 |
| 5 | Collecting Data and Information Activity Setting | 2.56 |
| 6 | Scientific Experiments and Hands-On Activity Setting | 2.55 |
| 7 | Community Related Learning Setting | 2.55 |
| 8 | Effective Circulation: Dynamic Learning Setting | 2.53 |
| 9 | Discussion and Presentation Activity Setting | 2.53 |
| 10 | High-Operational Performance Learning Setting | 2.53 |
| 11 | Flexible Activities Learning Setting | 2.50 |
| 12 | Social Activity Setting | 2.48 |
| 13 | Student Individual-Work Activity Setting | 2.46 |
| 14 | Students Collaborative-Work Activity Setting | 2.45 |
| 15 | Orderly-Configured Learning Setting | 2.39 |
| | **Overall Importance** | **2.53** |

Table 4.14 illustrates the gap between what has been believed important and what our schools had being unable to provide. The overall score –as showed by table 4.14 –for the most important activity setting –as determined by the participants –was 1.73 (partial good level), which was also the highest score obtained. If our school could not –at least – provide a good level for supporting what are believed to be the most important. Priorities the same time, we know that these schools were mainly designed to facilitate this issue, then; we should not expect to get much from these prototype models regarding the emerging educational issues. A clear example is the overall score given to implementing

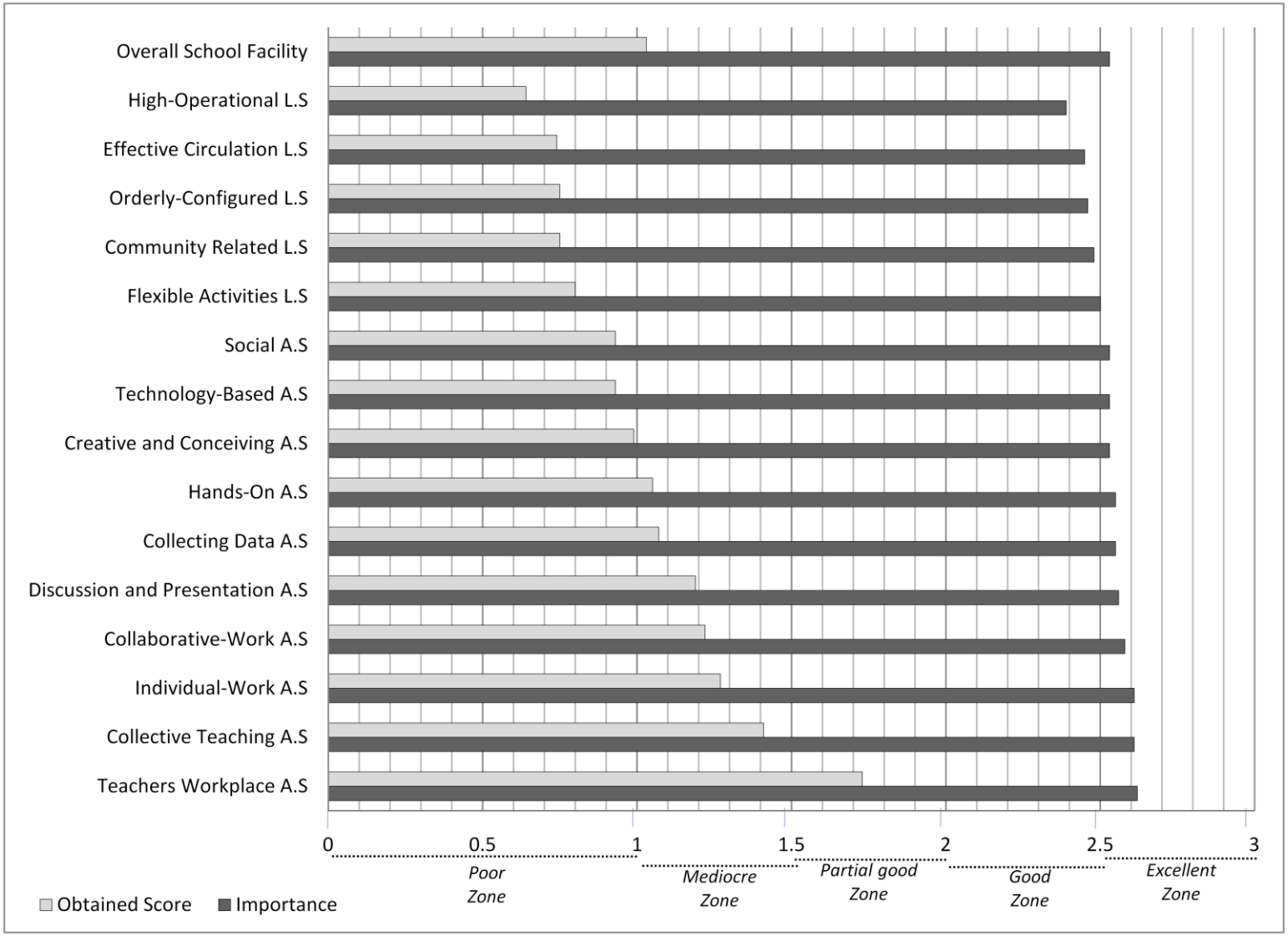
technology in the school environment. Technology, which is considered one of the most influencing factors in schooling, obtained the lowest score among all the identified physical settings (0.64 out of 3). The case was not different when considering other important factor such as social interaction, which obtained 0.74 out of 3.

***Table 4.14:*** *Ranking of Activity Settings by Obtained Score*

| | **Intended Physical Setting** | **Overall Score** |
|---|---|---|
| 1 | Collective Teaching (lecture) Activity Setting | 1.73 |
| 2 | High-Operational Performance Learning Setting | 1.41 |
| 3 | Discussion and Presentation Activity Setting | 1.27 |
| 4 | Collecting Data and Information Activity Setting | 1.22 |
| 5 | Effective Circulation: Dynamic Learning Setting | 1.19 |
| 6 | Teachers Workplace Activity Setting | 1.07 |
| 7 | Flexible Activities Learning Setting | 1.05 |
| 8 | Community Related Learning Setting | 0.99 |
| 9 | Orderly-Configured Learning Setting | 0.93 |
| 10 | Students Collaborative-Work Activity Setting | 0.93 |
| 11 | Scientific Experiments and Hands-On Activity Setting | 0.80 |
| 12 | Creative and Conceiving Activity Setting | 0.75 |
| 13 | Student Individual-Work Activity Setting | 0.75 |
| 14 | Social Activity Setting | 0.74 |
| 15 | Technology-Based Activity Setting | 0.64 |
| | **Overall Score** | **1.03** |

Figure 4.13; shows the significant gap between the importance level assigned for each activity setting, and the corresponding score given to each setting.

***Figure 4.13**: Summary of the Result for the Representative Sample of High-Schools (Chart Representations of Importance, Score, and Capability's Description)*



To sum up the discussion about the assessment of the school buildings, it is worth asking the question: ***Are the discussed prototype school buildings different, or are they similar, in terms of supporting the emerging educational requirements?***

Actually for the first look to the plans and the forms of the building we may think they are different. In fact they are quite similar or –at least –operated in a similar way. Although it is clear that there has been an effort to develop new prototype school models that are more responsive to the emerging demands of education and learning, we are still using the traditional classroom as the basic building unit in designing for the future. Between the hope to design the optimum school facility, and the great loyalty to the "one-size-fits-all" classroom, we have missed a lot of details. The matter in designing the optimum school facility is not only about how to arrange the classrooms. There should be concern first about what happens in the classrooms, and how we can extend it to the outside of the classrooms; to everywhere in the school, and even to the outside of the school. If what we are designing for is not clear, then, it is no wonder we end up with dissatisfying buildings even if we spend millions to obtain it. We need first to design a building for learning and then, anything should come after.

# CHAPTER 5

## DEVELOPING DESIGN GUIDELINES FOR THE IDENTIFIED ACTIVITY SETTINGS

### 5.1 The Approach of Developing the Guidelines

This chapter is directly intended to answer the third research question, what could be the characteristics of each learning activity setting within public high-school facilities? Answering this question is directly related to achieving the third objective of this study.

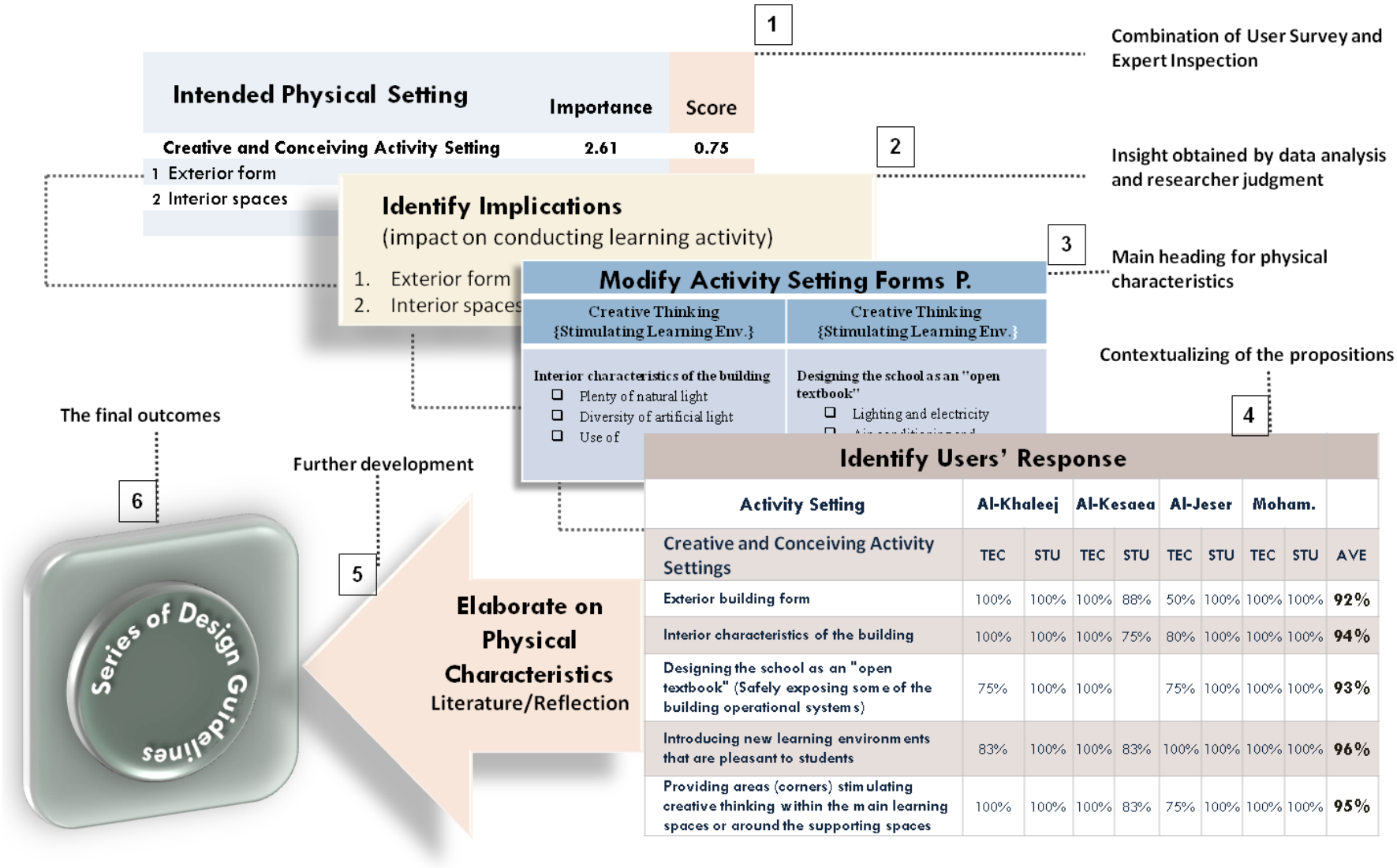
The exact processes adapted to answer this question were discussed in chapter 1, under the title: Research Methodology. In summary, the main approach to develop the guidelines depended on three main components: (1) literature review, (2) researcher reflection, and (3) school users' participation.

The extensive literature on education –which was discussed in previous chapters with particular reference to chapter four –has led to the identification of fifteen activity settings developed by the researcher. Identifying these activity settings has facilitated the process of developing a User' Satisfaction Survey (Appendix-E) based on the identified activity settings. In addition, an Expert's Inspection Form (Appendix-F) was developed to allow research input in the assessment process. The detail analysis of the assessment process was presented and discussed in chapter seven. Combining the results obtained from the user survey and the expert inspection has provided insight into the implications of not meeting the requirements of the identified activity settings. In addition, it has allowed to the researcher draw the main heading of the physical characteristics for each activity setting, which was developed form of an Activity Setting Form (Appendix-D).

Based on the modified Activity Setting Forms, school users including both teachers and students had the opportunity to express their opinions with regard to the proposed physical characteristics of the activity settings, and even to suggest any new ideas. This task was important because it exposed school users to the new directions of school facilities, and it contextualized the proposed alternatives of the physical environment to the people and place for which they were originally developed. The level of agreement with proposed physical characteristics are provided in Appendix-H. In addition to utilizing the data and information obtained from the above mentioned activities, a state-of-the-art literature review was conducted with regards to school facilities and learning activity settings. The review was presented –in detail –in chapter fife. The final stage toward elaborating on the shape of the physical environment was researcher reflections, which was required to synthesize and provide further explanation about each identified activity setting.

The generated guidelines were developed taking in to consideration the current and future schools, with more emphasis on the later. They can be found in the form of new concepts, emerging issues needing to be taken in consideration, basic approach toward providing alternative solution, and sometimes ready-use architectural details. Figure 5.1 shows the main approach used to develop the guidelines.

***Figure 5.1**: The Adapted Approach to Develop the Guidelines*



## 5.2 Teacher Workplace Activity Setting, Implications and Guidelines

### Finding Implications

| Teachers Workplace Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Teachers individual workplace | **1.17** | Individual workplace is the basic place for teacher work. Inadequacy of it may affect teacher performance in different ways. It hinders a teacher from carrying out his tasks and the preparation for the courses. It also could negatively affect his sense of belonging to the school. |
| Teachers collaborative and teamwork places | **0.86** | Inadequacy or unavailability of collaborative work area could cause them to miss great opportunities for teachers to learn from each other, and to work as a team, which result in deemphasizing collaborative culture among teachers and consequently in the overall school culture. |
| Teachers and administration meeting spaces/halls | **1.00** | A lack of well equipped meeting facilities could weaken the communication between administration, teachers and staff. It also could decrease the feeling of professionalism among teachers. |
| Small meeting spaces (teacher/teacher, teacher/student, teacher/parent) | **0.44** | The very low obtained score means there are very few opportunities for teachers, students and parents to meet and communicate in the school. These physical meetings are important especially when considering diverse learning modalities and the individual learner as the base of the educational process. |

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| Teachers' lounge (for social and break-out time) | **1.07** | Social interaction is a basic human need, and an effective way to foster the relation between the individuals and the space they occupy. Inadequacy of teachers' social spaces could cause to miss this benefit. |
| Office and technical accommodations | **0.31** | The very low score indicates the poor accommodation of teachers' offices which would ultimately affect teachers' functionality and their attitude toward their profession. |
| Teacher individual storage space | **0.70** | Individual based storage is required for teacher's belongings and to keep student work. Insufficiency of storage spaces could hamper teacher work, and might even influence the way teacher deliver the course to the students, as there is no space to keep student work. |

## Proposed Guidelines

| | **Proposed Guidelines** | **Level of Agreement** | **Reflection** |
|---|---|---|---|
| ***Teacher Workplace*** | | **88%** | ***Note**: Main features related to the individual workstation are provided under "Individual Work Activity Setting".* |
| G01 | **Provide private office for senior teachers** | | A senior teacher is expected to have communication and activities with organizations/institutions outside the school. In addition, he may supervise a group of teachers with similar specialties, or coordinating a multi-disciplinary team. Thus, it is highly recommended to provide private office for senior teachers. The office can be located close to the teacher common working area. |

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| G02 | **Provide teacher individual workstations** | A group of teachers (small group size is preferred) is recommended to share a common working area. Each teacher is provided with individual workstation manufactured to allow a high level of customization to and acceptable level of privacy in order to suit individual needs. |
| ***Teachers' Collaborative Working Environment*** | **94%** | **Reflection** |
| G03 | **Provide teachers' collaborative-based workspaces** | It is recommended to have more than one collaborative work area based on the intended activities. Then, each space is detailed further to suit its main function. In general, as these activities are intended to be carried out within interactive social engagement, special attention should be given to the flexibility of the space including furniture and work surfaces.<br><br>*Further teachers' collaborative settings are provided under other activity settings based on the nature of the activities.* |
| G04 | **Provide space for teachers' brainstorming** | Provide space to stimulate teachers to think creatively and generate new ideas, concepts, examples, and teaching methods that can be implemented in the learning process. A stimulating teachers setting with thoughtful social interaction consideration will help teachers while preparing for course topics and contents to meet the above issues.<br><br>*Related guidelines are provided under "Stimulating Learning Environment".* |

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| G05 | **Provide space for teachers' discussion and exchange of knowledge** | | Provide a setting to encourage teachers to discuss and exchange the state-of-art educational matters so that a professional open dialogue between teachers is always supported by the physical environment.<br><br>*Related guidelines are provided under "Discussion and Presentation Activity Setting".* |
| ***Meeting Spaces*** | | **100%** | **Reflection** |
| G06 | **Provide professional meeting halls/room** | | Schools should have a facility for accommodating professional meetings involving teachers, school's administration and professional members from the society. It is highly recommended for the space to have online video-conference capability. The space should be provided with state-of-art meeting room furniture and equipments. It should also be located so that it encourages teachers and school administration to meet frequently. |
| G07 | **Provide spaces for short meeting and intimate conversation** | | Provide spaces suitable to accommodate planned and spontaneous meeting between teacher(s)/teacher(s), teacher(s)/student(s), and teacher(s)/parent(s). A teacher's meeting space could be provided within, or close to, the teachers work area. A teacher/students meeting space should be provided so that it encourage students to meet and sit with the teacher. For example, a niche or a recess in the corridor can be utilized for this purpose. When providing a teacher/parent meeting space, the ease to finding the place to the teacher should be considered. |
| ***Social spaces*** | | **86%** | **Reflection** |
| G08 | **Provide lounge(s) for teacher social interaction and breakout time** | | It is not enough to provide a workplace for teachers and assume it would accommodate the social needs of the teachers. A devoted space should be provided with less formal design and comfortable furniture should be provided where |

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| | | | teachers can spontaneously sit, interact, or get coffee and snacks.<br><br>*Further guidelines related to work with others are provided under "Social Activity Setting".* |
| ***Storage spaces*** | | **88%** | **Reflection** |
| G09 | **Provide teacher's personal-based storage** | | Whatever the type of teacher's workplace, a personal-based storage space should be provided for all teachers. Teacher needs a personal and secure storage to keep their personal belongings and to keep students' work. It is highly recommended to arrange all/most of the individual storage spaces around teacher individual workplace, and avoid the use a common area for storing. |
| ***Workplace accommodations*** | | **91%** | **Reflection** |
| G10 | **Provide basic offices devices and tools for teacher use** | | Basic offices devices such as telephone, printer, fax, and scanner should be provided either in individual or shared-based strategy. In addition to their functionality, they will have great impact on teachers' emotion and behavior so that they feel they are in a professional discipline. |
| ***IT utilization*** | | **81%** | **Reflection** |
| G11 | **Utilize IT resources to increase teachers' productivity and connectivity.** | | All teachers in school should have a computer or notebook connected to local network (LAN), which is linked to a fast internet connection. It is strongly recommended to utilize wireless network and the use of notebooks and pocket PCs (or personal digital assistance PDA). |

## 5.3 Collective Teaching (lecture Format) Activity Setting, Implications and Guidelines

Lecture format teaching space is the activity setting most similar to the conventional classroom setting. The only difference is that the need for the approach will be much less, thus the setting will not be the dominant feature in the learning environment. The setting aims to support teacher's activities and delivery of knowledge, as he the most active person within lecture format learning. The students within this setting are not intended to do most of the work. They will be there only when there is a need to be there.

### Finding Implications

| **Collective Teaching (lecture Format) Activity Setting** | **Obtained Score (out of 3)** | **Implication** |
|---|---|---|
| Teacher's position and his active work area with relation to learners' positions within the main learning spaces (classroom, laboratory) | **1.84** | The obtained score is the top score obtained among all assessed criteria. It is within an acceptable level, which ensures that these prototypes have been designed for teacher-centered learning. |
| Availability, location and accessibility of presentation and explanation tools for teacher use | **0.99** | Although the overall setting is considered as a 'teacher-centered' setting, the result has shown incapability of the settings to support presentation and lecture delivery means that are highly demanded by teacher. This will has the potential to push teacher use conventional methods rather than utilizing variety of means including IT. |

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| Location of presentation and explanation tools to the audience (sight angle) | **1.35** | The obtained result was below the average. This will have the potential to cause difficulties for the students to concentrate in the lecture, and may cause them to miss some of the important information related to a certain topic. In addition, it may cause students to lose interest during the class. |

## Proposed Guidelines

| **Proposed Guidelines** | | **Level of Agreement** | **Reflection** |
|---|---|---|---|
| ***Teacher Workspace Area*** | | **84%** | |
| G12 | **Ensure teacher centric position** | | This is to ensure that the teacher working area is the focus of all students. The typical teacher's location in a classroom is suitable. However, enough distance between teacher desk and students' sittings should be maintained so that sight lines are not hindered by very sharp angle. |
| G13 | **Prominence of teacher working area** | | Although it is highly recommended to keep low numbers of students, in a case of large number of students (more than 30), the teacher work area is recommended to be elevated from the ground level of the space depending on the depth of the room/hall. |
| G14 | **Accommodation for teacher presentation and display** | | Ensure availability of presentation resources within the teacher working area. It is also important to ensure ready access to the resources. |

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| G15 | **Organization of projection and display surfaces** | Ensure all projection surfaces are located within the vertical plane behind the working area for the teacher, and orthogonal with the students' seating plane. Also, ensure that most of the display surfaces are placed in the horizontal plane between the teacher and the students. |
| ***Students Seating Layout*** | **86%** | **Reflection** |
| G16 | **layout students' setting for effective visual and audio communication** | Arrange students' seating so that they face the teacher working area with as minimum incident angle as possible. The layout should avoid long row layout (as it causes low incident angle), and long column arrangement (as it results in visual audio difficulty). |
| G17 | **Ovoid circulation within active working areas** | Circulation should be avoided within the teacher main working area and minimized within the active zone of students seating area. This could be achieved by introducing main circulation paths at the two sides and the back of the space. |
| G18 | **Use low-profile equipments and furniture for both teacher and students** | This is intended to ensure visual communication between teacher and students. |
| G19 | **Arrange large devices to the sides of the settings** | Whenever devices with large profiles (such as desktop computer or CRT monitor) are used, they should be placed to the outer side between the teacher and the students. This should be applied at micro scale (students/teacher) setting, and macro scale (overall classroom setting). |

## 5.4 Student Individual-Work Activity Setting, Implications and Guidelines

### Finding Implications

| Student Individual-Work Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Adequacy of working surface to accommodate various and simultaneous works | **0.72** | Individuals within learner-centered learning do more than just listen to adults. This requires individuals to got involved in conducting various activities in his work surface. The activities may include critical thinking, data processing, problem solving, reading, writing, and using computer. He may need to conduct more than one activity at the same time, which is far beyond the capability of a conventional student's table. |
| Sufficiency of workplace area to accommodate functional and personal needs | **0.69** | The Individual will be encouraged to use variety of means and tools that could help him perform better. As this differs from one person to another, the space assigned to each individual should accommodate his personal stuff, or else it could not be considered as an individual workspace. The obtained result has shown incapability of the existing workplace to do that. |
| Ability to adapt the workplace to satisfy the needs and desire of the user (adding personal touches, personal storage, adjustable furniture, task light) | **0.75** | Inadequacy of individual workstations to satisfy user's needs either functionally or behaviorally means the space is not the ideal place for student to conduct individual work. This will have the potential to hinder students work and weaken student sense of belonging to the space. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| *Adequacy of Working Desk* | | **100%** | |
| G20 | **Provide student's individual workstation** | | Special attention should be given to the design of student's individual workplace as it is considered the basic unit in composing the overall working setting. The conventional desk and chair should be reconsidered. The recommended workstation of individual should be capable to accommodate more than one activity at the same time, such as writing, reading and using of notebook. In addition, it should meet individual and personal human needs.<br><br>*Related guidelines are provided under the sub-heading "Personalization of the Workstation"* |
| G21 | **Provide student's personal-based storage** | | The conventional practice of limiting student storage space to the small shelf built-in student desk is not enough at all. Actually, it is not considered as storage space; it is neither enough, nor secure. In addition, the traditional lockers area found in some school is also not recommended as it overlooks the social potential of the space. The basic form of personal storage should start from the student's workstation. It is recommended to provide workstation that has lockable shelves. Additional storage spaces could be provided for group of students based on individual units for student to keep his notebook and large items. |

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| ***Technical Provisions*** | | **94%** | **Reflection** |
| G22 | **Provide some technical element on workstation individual based** | | Individual workstation should be perceived as a reduced model of an effective and productive working space. Thus, demanded technical elements such as electrical outlets, network and internet access, and task light are recommended to be considered for each workstation. |
| ***Acoustical Performance*** | | **94%** | **Reflection** |
| G23 | **Ensure adequate sound performance of the workstations and the place in which they are located** | | Individual deskwork is intended to carry out tasks that require student to concentrate and be productive. Thus, the ability to maintain low noise level is of great importance. This requires to thoughtfully selecting the location of the individual workstations which is recommended generally to be located away from noisy activities and too open spaces. Also, the suitability of the building materials, finish and furniture are important. The finishes of the workstation itself is significant because it needs to be sound absorbent. |
| ***Personalization of the Workstation*** | | **93%** | **Reflection**<br>***Note**: Main features of individual workstation (teacher/student).*<br>*Although the guidelines are provided for both teachers and students, the level of implementing them for both should vary. The guidelines are intended to provide general approach for addressing the issue of personality of the workplace that is applicable to any level of users.* |

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| G24 | **Clearly identify individual territory** | It is important to identify the working area for the intended user and other spaces occupants. Within his area, the intended user has full authority, and for the others; their curiosity is ended. Identifying the individual boundary could be achieved through the use of partitions and furniture, and the use of different finishes and colors. |
| G25 | **Provide sufficient level of privacy** | Assure suitable level of visual privacy and good acoustical performance for the overall activity setting. In addition, the layout of the seats and desks should be thoughtfully considered so that it enhances individual privacy. |
| G26 | **Allow acceptable level of personality** | It is highly recommended for the design of personal space to allow the individual to express his identity. Such workstations will have places where individual can post some personal stuff and allow certain modification based on individual wish. |
| G27 | **Use of ergonomics furniture** | The Individual workstation is primarily intended for conducting work in an effective and productive manner. One of the main issues related to that is to have comfortable furniture. The use of ergonomics furniture should replace the conventional hard surface wooden chair. Ergonomics furniture is designed based on anthropometrics science, which concern human dimensions and comfort. |

## 5.5 Students Collaborative-Work Activity Setting, Implications and Guidelines

### Finding Implications

| Students Collaborative-Work Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Availability of various working environments with different features to accommodate several activities' needs | **0.76** | The very low score has indicated incapacity of the existing prototypes to support diversity of learning activities and teaching approaches. This means there is a main defect in the basic structure of the existing school models to support 'learner-centered' learning, which is the key for future education. |
| Easiness to arrange furniture and work surfaces to form divers group sizes | **0.96** | Incapability to facilitate collaborative setting within classroom. This will have the potential to consider the conventional classroom layout as the 'default' setting, and will discourage teachers to explore alternative settings that could be more suitable to conduct certain activities. |
| Easy movement and transition between activities within learning space, and within the school | **0.77** | The low score has indicated the static nature of the existing schools. This contradicts with the dynamic nature of future school, where students are encouraged to move from one learning setting to another based on the needs of individuals or groups. |
| Storage spaces for team's work | **0.75** | Collaborative work requires students to be active and productive. In addition, it is experienced more effectively in project-based learning. These features of collaborative work require spaces for students' teams to store their completed and in-progress work, which is not supported by the existing school models. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| ***Availability of Divers learning Environments*** | | **98%** | |
| G28 | **Divide the physical setting to accommodate variety of activities** | | Within a certain period of time, students will not be necessarily involved in similar activities. Therefore, the collaborative activity setting should be designed based on accommodating multi-activities such as group work, presentation and discussion, brainstorming, hands-on activities and individual tasks. In laying the space, a special consideration should be given to the nature and the relation between the activities so that conflict is reduced.<br><br>*Further guidelines are provided under other "Orderly-Configured Learning Setting".* |
| ***Seating, Furniture and Working Surfaces*** | | **88%** | **Reflection**<br>***Note**: More Related guidelines are provided under "Flexible Activity Setting"* |
| G29 | **Arrange students' seating in cluster layout** | | Although group members are expected to communicate with other groups or members of other groups, the basic setting of each group should be designed primarily to enhance communication between group's members. The traditional arrangement of isolating each student from others must be avoided. Instead, a cluster arrangement in which two to six students are grouped to work collaboratively should be dominant.<br><br>*Further guidelines related to work with others are provided under "Social Activity Setting".* |

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| G30 | **Clearly identifying group active area** | While the whole activity setting should encourage collaboration among users, it is equality important to identify an area or setting for each group. This setting will be considered as the 'headquarter' for the group's work. The basic geometrical form used for the activity settings will have an impact on the potential utilization of the space. For example; while a rectangular shape has four main coroners, an octagonal shape has eight coroners, and consequently more potential areas for group settings. |
| ***Movement and Transition between Activities*** | **94%** | |
| G31 | ***Related guidelines are provided under "Orderly-Configured Activities Setting"*** | |
| ***Group Work Storage Spaces*** | **94%** | **Reflection** |
| G32 | **Afford adequate storage spaces to accommodate groups work** | As students work in groups, –especially with project-based learning –the time needed to complete the work will vary from group to other. Also, the work may extend for more than one period. Thus, it is important to provide adequate storage spaces to keep in progress groups' work, or even completed work/project. The type of storage space will depend on the type of materials intended to be stored. The same point is also valid for teachers' collaborative work. |

## 5.6 Discussion and Presentation Activity Setting, Implications and Guidelines

### Finding Implications

| Discussion and Presentation Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Availability of spaces encouraging discussion of teachers/students and students/students | **0.90** | Fewer opportunities to initiate formal and informal dialogue between teachers/students and students/students that will have impact on the overall school culture. |
| Availability of sufficient and various places to present students works | **0.88** | Fewer avenues to present student's work to teachers, peers, and the public. This has the potential to demoralize students' momentum to work and compete with colleagues. In addition, it has the potential to weaken the sense of belonging to the school. |
| Availability of various means for explanation and presenting information, and exchanging ideas | **1.57** | The result has shown a score that falls at the lower stage of average level of adequacy. This will have the potential to hider the process of acquiring and dissemination of knowledge. |
| Ready access and use for the presentation tools whenever needed by teachers/students | **0.90** | Limiting the accessibility of the tools used to present and exchange knowledge to a predetermined or prescriptive manner will have the potential to contradict with the natural pattern of practicing learning which is emerging from learners' needs and capabilities. |
| Availability of electrical and technical supports | **1.40** | Difficulty to maintain efficient performance of the required equipments and the potential to waste a lot of time that should be utilized in learning. |

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| Environmental quality of the space for discussion and display | **1.20** | Inadequacy of environmental parameters (lighting, acoustics, and thermal performances) will have the potential to reduce the benefits of adapting discussion and using presentation technologies. In addition, it could cause environmental problems (such as noise, visual difficulties such as glare) for other learning activities conducted at adjacent spaces. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| ***Spaces for Discussion*** | | **96%** | |
| | ***Collective Discussion (large group)*** | | |
| G33 | **Design discussion settings with minimum obstacles** | | Running a presentation and conducting a discussion for a large group requires designing a spacious space with minimum obstacles to maintain visual communication between the presenter/organizer and the audiences. Therefore, the plan of the school should not be limited only on space dimension that is repeated all around. There should be larger space with a longer structural span. |

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| G34 | **Arrange participants seats with direct communication to discussion organizer** | To maintain active participation from all the students, the discussion setting should be designed so that all students feel their participation is welcomed as others. The layout setting should avoid the common rows and columns arrangement. The aim of the layout should be to maintain an equal distance between the organizer and the participants. Thus, arranging participants' seats in circle or horse-shoe shapes are more suitable for discussion. In case discussion is taking place in a multi-functions space, the furniture should be very flexible. |
| G35 | **Centralize the arrangement around discussion organizer** | In the case that all classroom students are participating in one discussion session, it would be highly recommended to arrange the setting around one plane, usually the one behind the session organizer. The presentation tools and the display surfaces should be also arranged around the session organizer/presenter. This is intended to maintain effective visual communication and to increase students' concentration. |
| | ***Small group discussion*** | |
| G36 | **Provide sufficient places facilitating dialogue and discussion** | The design of the school should give equal importance to any form of dialogue; either facilitated by the teacher or initiated by students. Therefore, the design of the classroom should facilitate initiating discussion and negotiation within small groups by providing the requirements of the presentation and discussion in small scale. In addition, there should be certain areas adjacent to the classrooms where dialogue can be initiated. |

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| G37 | **De-emphasize the front of the setting** | In the case where the classroom is designed to accommodate several groups working collaboratively at the same time, it is recommended to de-emphasis the 'front' of the classroom. This is intended to make the students attracted to the group setting rather than the whole classroom setting. |
| G38 | **Provide informal dialogue setting** | Informal settings or home-base setting are needed to attract students and stimulate their social potentials. When students are allowed to be as they want to be, the potentials to express their identities and their opinions become greater. The school design should take care of the many spontaneous chatting opportunities between students, and it should encompass them to be avenues for positive discussion and knowledge exchange.<br><br>*Related guidelines are provided under "Social Settings".* |
| ***Display Students' works*** | **100%** | **Reflection** |
| G39 | **Provide sufficient and divers places to present and display students works** | The school facility should have many places to display students' works. This should including completed works or works in progress. These places will be a key to initiate spontaneous discussion and negotiations between students, faculty and the users of the school building. |

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| ***Presentation Tools*** | | **92%** | **Reflection** |
| G40 | **Provide divers tools for presenting and exchanging knowledge and ideas** | | The activity setting designed to facilitate presentation and discussion should be equipped with variety of presentation tools including traditional wallboards, transparency-projector and slides-shower, and interactive whiteboards, and multimedia display devices: CDs/DVDs/Blue-Rays players, computers/notebooks and overhead projectors, and plasma/LCD display monitors. |
| ***Accessibility to Tools and Devices*** | | **89%** | **Reflection** |
| G41 | **Ensure Accessibility and ready use presentation tools whenever needed by students/teachers** | | As learning is centered on individual and groups of students, they should not have difficulty to use presentation devices and other means when they need them. Actually, the design of the learning setting should stimulate the learners to present their work and exchange their ideas with others. Thus, the learning environment should be equipped with these tools considering different levels of use; small group (ex: 2 to 6) large group (ex: 6 to 12), or the whole classroom. In order to ensure that the basic learning space (the classroom) should be designed to contain some of these devises so that several groups in the classroom can be engaged in discussion and presentation at the same time. The other ways to do that is to provide some of these requirements within a cluster of classrooms. In addition, there should be space(s) designed exclusively for presentation and discussion. |

| *Environmental Treatment* | | 98% | **Reflection** |
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| G42 | **Ensure suitable visual treatment of presentation setting** | | It is very important for the activity setting designed for presentation and discussion to be thoughtfully considered about the visual performance. For presentation purpose, too much light is not recommended, while for discussion it would be preferable to ensure sufficient light. Direct light (natural or artificial) it will be inconvenient and will case glare effect.<br><br>*Related guidelines are provided under "High-Operational Performance, Light Performance".* |
| G43 | **Ensure suitable Acoustical treatment of presentation setting** | | It is expected that there will be quite a level of noise associated with discussion and presentation settings. Therefore, the design of these settings should consider the various aspects of acoustical performance. While in design space exclusively for presentation and discussion amplifying the sound would be desired (without disturbing other functions in the school), designing spaces to accommodate various groups engaging in separate discussions requires a different approach to the acoustical performance of the space.<br><br>*Related guidelines are provided under "High-Operational Performance, Acoustical Performance".* |
| *Technical Support* | | 91% | **Reflection** |
| G44 | **Provide adequate technical and logistical support for presentation and discussion** | | Many small things will influence the discussion and presentation setting. For example; the uses of computers, notebooks and even pocket PCs have increased. Consequently, there will be a great demand for electrical power to recharge them, which requires the instillation of many electrical power outlets, similarly with electrical extensions. |

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| | | Also, it is not enough to provide an overhead projector without thinking about the projected surface. In some of the assessed schools there was a projector in the library, but there was no suitable surface to project on it. The experience in such spaces has shown that it is very important to have specialized technician(s) in the school that could be contacted to provide help when it is needed. |

## 5.7 Collecting Data and Information Activity Setting, Implications and Guidelines

### Finding Implications

| Collecting Data and Information Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Availability of various educational materials resources to obtain data and information (written, audio, visual, an electronic) | **0.99** | Increasing the dependency on the conventional methods of teaching (teacher-centered learning), and deemphasizing learning-centered approach which is concerned about developing learning skills and the ability to obtain data and information from multi-resources. |
| Ready access and use of educational materials whenever needed by teachers/students | **1.01** | Inefficiency in coping with the requirements and needs of teachers/students will have negative effects on the concept of continuous learning, and learner-centered learning. |
| Closeness of learning resources spaces from students' workplaces | **1.33** | Inadequacy of spaces relationship will have the potential to negatively influence the frequency of using learning resources by the learner. |
| Availability of learning resource within classroom (books, computers, electronic network) | **0.64** | The Poor result indicates the poor provisions provided in existing classrooms to accommodate students' active-mode of learning. This will have the potential to foster conventional learning approaches, less utilization of basic learning spaces, less utilization of IT, and more time wasted. |
| Material and resources security and storage spaces | **1.21** | The possibility to miss use school resources and the potential to encourage miss-behavior such as vandalism and stealing. |

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| Visual and acoustical treatment of the spaces | **0.60** | Inadequacy of the visual and acoustical performance will have the potential to introduce problems for the users of the resources. In addition, it could cause environmental problems such as increasing noise level and visual inconvenience for other users. |

## Proposed Guidelines

| **Proposed Guidelines** | | **Level of Agreement** | **Reflection** |
|---|---|---|---|
| ***Diversity of Educational Materials*** | | **93%** | |
| G45 | **Provide various educational materials** | | A wide collection of educational material should be provided for the use of teachers and students. Educational materials may include written documents such as references, books, newspapers, periodical journals, and films, tapes CDs and DVDs, and picture, solids, transparent materials, and 3D pictures, maps, posters and illustrations, and Reduced and natural models, and on line materials. Thus, there should be places within basic learning (such as classroom) space or specialize learning spaces (such as learning resources) to accommodate these resources. |
| ***Diversity of Learning Resources*** | | **100%** | **Reflection** |
| G46 | **Provide divers learning resources** | | In addition to the mentioned educational materials, the design should consider providing variety of tools, equipments and devices such as notebooks, computer and networks to facility the acquisition of knowledge for teacher and students. |

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| | ***Accessibility to the Materials and the Recourses*** | **94%** | **Reflection** |
| G47 | **Ensure accessibility to educational materials and learning resources for all faculty** | | It is very important to ensure ready access to the various educational materials and resources for all teachers. Limiting the authoritization of these resources to specific teachers is an old fashion used when the availability of the material and resource were rare, and only few people knew how to deal with them. While there are specialized materials and resources that require more responsibility by the individual, school design should put in consideration the potentials benefits of using educational materials and resource by all teachers. Thus, accessibility to the resources should start from individual workstation and extended to easy use of specialize resource spaces for all. |
| G48 | **Facilitate accessibility to educational materials and learning resources for all students** | | Limiting the use of educational materials and learning resources by students to a predetermined schedule is a major contradiction to the learner-centric approach. In contrast, school design should seek all means that would encourage students to extensively use learning resources.<br><br>*Related guidelines are provided under "Technology-Based Learning Activity Setting".* |
| | ***Accessibility of Learning Recourses Spaces*** | | |
| | ***1.Within or Close to Basic Learning Space (BLS)*** | **99%** | **Reflection** |
| G49 | **located some of the educational materials and learning resource within main learning settings** | | The best way of implement learning materials and resources in the learning process is to provide some of them in the main learning place (traditionally the classroom). Thus, the design of |

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| | | | the basic learning setting should consider the integration of the learning materials and resources into the learning environment. This should be accomplished while maintaining collaborative atmosphere, and flexible and easy to move physical setting. |
| G50 | **Provide dispersed learning recourse units** | | While providing learning resources in the basic learning space is the optimum form for integrating them into the learning process, provide dispersed learning recourse units is another beneficial design strategy. Providing more than one area for learning resources is highly recommended with clustered layout of the basic learning spaces (BLS –in the traditional sense it is the conventional classroom). A number of BLS can be arranged so that it is supported by a small –but effective –unit of learning resources. |
| | ***2. Specialized Learning Resources Area*** | **98%** | **Reflection** |
| G51 | **Provide specialize space for learning resources (SLRA)** | | Sometimes it is not advisable to provide all types of learning resources within spaces not exclusively designed to accommodate learning resources. In addition, in some cases the learning process requires all students to be engaged in collecting data and information from different resources. Designing a specialized learning resources area capable to accommodate large number of students at the same time is one of the main concepts receiving great attention. |
| G52 | **Design SLRA to accommodate variety of activity settings** | | When large specialize learning resources area is sought, it should be perceived as the academic and social hub of the school. Thus the design should consider the capability of the space to accommodate variety of activity settings including: books and reference holding area, educational materials holding area (such as CDs, DVDs, cassettes, and slides), computer and technology area, discussion and presentation |

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| | | | setting, short lecture delivery setting, bays for individual and small group work, quiet reading area, and social zone.<br><br>*Further guidelines are provided for accommodating variety of activities under "Flexible Activities Learning Setting".* |
| G53 | **Assign strategic location for SLRA** | | With the availability of SLRA, students are expected to spend a quiet period of time in it. Also, students and faculty will need to visit SLRA on an individual base as they need to do so. Thus, the location of the SLRA should be accessible and easy to reach for all school's users. Actually, the design should consider the possibility of arranging several spaces –especially academic spaces – around SLRA.<br><br>*Further guidelines about the organization of school spaces are provided under "Orderly-Configured Learning Setting".* |
| ***Storing and Security*** | | **94%** | **Reflection** |
| G54 | **Provide adequate storage for educational materials and learning resources** | | There are many types of educational materials and learning resources come with different shapes and size. Consequently, the design should consider the adequacy of the spaces used for storing this stuff in terms of their sufficiency, suitability, accessibility and security. |

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| G55 | **Ensure nature surveillance for educational materials and resources** | Materials and resources are valuable school assets. Many of these assets are widely used by most level in the society. For optimum school, serving the community is one of the main objectives. Whenever these materials are used –from inside the school or outside it –it is highly recommended to ensure natural surveillance for them. The first step towards natural surveillance is the proper location of the space containing the materials and the resources. Then, this surveillance could be promoted by ensure transparent interior design. |
| G56 | **Supplement nature surveillance by using security system** | With the availability of expensive resources, and during the time when fewer users are expected, it is recommended to supplement the natural surveillance strategy with physical and electronic security system such as lock and surveillance camera. |
| | ***Environmental Treatment*** | |
| G57 | **See "Discussion and Presentation Activity Settings" and "High-Operational Performance Learning Setting"** | |

## 5.8 Scientific Experiments and Hands-On Activity Setting, Implications and Guidelines

### Finding Implications

| Scientific Experiments and Hands-On Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| ***Scientific Experiments*** | | |
| The ability to see experiments and demonstrations clearly by all students | **1.28** | Inability to achieve that implies there are some students who will not be capable at following up with the teacher and will miss a part of the demonstrations. This also will have the potential to lose interest from the side of the students. |
| Ready access and use to materials and devices needed to conduct experiments | **1.00** | The result has implied that conducting experiments or hands-on activities are limited to a prescriptive manner. This manner will cause them to miss the spirit and benefits of hands-on activities which aim to develop scientific learning approach that allow learner to utilize all available resource when he needs them. |
| Adequacy of working surfaces to accommodate various activities (collecting information, planning for experiment, writing reports, discussing works) | **0.80** | Experiments in the classroom are not only a show of teacher work. In addition, students will be expected to do experiments and do other activities associated with it. This will be done as individual or small groups. Inadequacy of the working desk to do these activities could cause to miss some of the benefits/data/information of conducting the experiment. |
| Adequacy of safety requirements | **0.98** | The result has shown a poor level of safety provision in laboratories. Even if it is assumed it not directly related to the topic, safety provision –especially in labs –must not be compromised. |

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| ***Other Hands-on Activities*** | | |
| Availability of general use labs/workshops (arts, crafts, science) | **0.40** | Inability to develop general life skills which are considered an important aspect of the overall development of the students and preparing them to be active members in their small communities and their large societies. |
| Availability of workshops for heavy projects (building, painting, repairing) | **0.37** | |
| Availability of sufficient spaces to display students works | **0.77** | Fewer avenues to present student's hands-work work (completed or in-progress) to teachers, peers, and the public. This has the potential demoralize students momentum to work and compete with colleagues. In addition, it has the potential to weaken the sense of belonging to the school. It will also miss a great opportunity to provide prove for the out-come of the learning and the students achievements. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| *General Concept for Hands-on Activities* | | | |
| G58 | **Design SEL for general purpose rather than very specialize SEL** | | Specialized laboratories are expensive, and need to be renewed them periodically to keep them up to date, which is difficult to achieve. Experience has shown that providing general purposes labs is more appropriate for high school. However, these general labs should always meet the common requirements of the academic contents, and the functional requirements of scientific experimental laboratory such as availability of energy, power, equipments and store. |
| G59 | **Design laboratory area like a professional 'science suite' rather than isolated laboratories** | | Laboratories are usually arranged either along a corridor, or organized in cluster containing more than one laboratory. Laboratory area should appear as a professional science suite. This requires more than just providing the 'active area' which is a typical high school science lab. The suite will have a place where the students (or researchers) get a break from hand-on activities and think creatively (guidelines are provided for stimulating creativity setting). Also, the suite will have a place where complete work or works in progress are displayed. This is in addition to the other spaces such as storages and preparation space, which are provided within typical high schools. |

| *Scientific Experiments laboratory (SEL)* | | | |
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| ***Collective Teaching and demonstration*** | | **96%** | **Reflection** |
| G60 | **Design SEL for effective collective lecture, demonstration and discussion** | | Short lecture followed by experiment demonstration associated with discussion commonly take place at the beginning and at the end of the experiment exercise. Therefore, the design of the lab should not neglect these issues due to the common belief that laboratory is a place to conduct an experiment. The front of the lab should be wide enough for one or two persons to deliver a lecture. In addition the front area should be equipped with necessary tools for presentation without hindering communication between the presenter and the audience, without feeling that the space is too crowd. Furthermore, students should be able to see the demonstration clearly, and taking note while they are seated in their places. This requires to design the space without any obstacles, and to assure that seating in the front does not blocking the view for the students seating in the back.<br><br>*Related guidelines are provided under more than on topics based on the intended activity*. |
| ***Laboratory Activities*** | | **94%** | **Reflection** |
| G61 | **Arrange groups setting in SEL fairly apart** | | This is intended to assure that groups are working without being crowded by others. Also to ensure all the members in the groups can see demonstration clearly. In addition it is intended to facilitate teacher circulation around the groups. |

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| G62 | **Ensure ready access to SEL services and equipments by all groups** | SEL services and equipment should be centered on the groups setting. The design should make the required tools, equipment, power and heat sources, faucet and washbasin easily accessible for each group. The members in each group should be able to work as a team conducting an experiment, and also be able to conduct some individual task within group settings.<br><br>*Related guidelines are provided under "Flexible Activities Learning Setting".* |
| ***Non-Laboratory Activities*** | **97%** | **Reflection** |
| G63 | **Design SEL group setting to accommodate variety of activities** | The group and individual will not be only engaged in doing experiments, they will need to collect data and information, planning for the experiment, writing reports, using notebooks and discussing work. The design of the students' settings should consider the capability of the setting to support these activities.<br><br>*Further guidelines are provided about flexible under "Flexible Activities Learning Setting".* |
| G64 | **Design SEL to accommodate increases use of IT** | Research shows that the increase in using IT and computers are a key influencing factor in design high school science lab. Potential use of IT includes research, presentation, data logging, and sometimes for simulating experiments that are too expensive or time consuming to be carried out live in school. Thus, the design of SEL should accommodate IT by making them available and ready to be used by teachers and students. |

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| | ***General Project Workshop (GPW)***<br>*Multi-Purpose Workshop (MPW) (94%)*<br>*Heavy Project Workshop (HPW) (96%)* | **95%** | **Reflection**<br>***Note**: GPW consists of two types of spaces: MPW and HPW. Because the proposed guidelines are applicable for both spaces, they were merged into one list. The level of agreement accounted represents the average of both types.* |
| G65 | **Provide GPWs for various purposes including craft, arts, and science** | | The hands-on activities in the high school should not be limited only on conducting scientific experiments. As school is designed for learner-centric and project-based learning, students will be extensively engaged in manipulating objects for various purposes. For example, while there will be students who prefer to present their work verbally, other will prefer to preset their work visually by making drawing or physical models. Thus, School design should facilitate more than one option for students to develop knowledge and for presenting solutions. |
| G66 | **Provide area within GPWs for heavy projects** | | In addition to routine project-based activities, students will be engaged in heavy projects such as building, welding, carpentry and painting. Thus, GPWs should have area within them where these activities can be conducted efficiently. It is recommended to have a direct connection between the general and heavy project areas, but within the limit that they are not interfering with each other. |
| G67 | **Allow GPWs to be divided into smaller bays** | | It is highly recommended for the GPWs to allow larger number of students working at any time. Thus, the design of GPW should be flexible in term of the ability to divide the spaces into small bays used by individual and small group put on consideration the nature of the work to be done and the time required for it. |

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| G68 | **Provide flexible services distribution** | Services distribution is crucial for efficient GPW labs. Three main systems are available: under the floor, perimeter, and overhead. Each system has its advantages and drawbacks. More than one system can be adapted for more flexibility. The school design should consider which system(s) is more suitable for current and future demands. |
| G69 | **Ensure GPWs stable power supply and flexible utilities** | A great consideration should be given by the design to the stability of the electrical power and the layout of the supporting utilities such as water supply and heat sources. These elements are the key toward designing successful GPWs. The design should ensure stable supply of utilities and flexible arrangement as they are used by individuals and groups. |
| G70 | **Provide GPWs with specialized tools and devices** | Especially for the heavy project area, they should contain some specialized tools based on the intended use. This is for conducting tasks efficiently and safely. |
| G71 | **Furniture GPWs with flexible and maintainable furniture and finishes** | More than any other places in the school, GPWs should have the most heavy duty furniture and finishes. Finishes and furniture should be selected based on their durability, resistance to damage, and easiness to clean and fixed. |
| G72 | **Ensure smooth students movement and large device accessibility between GPWs areas** | GPWs by its nature are active areas where students are moving from one space to other carrying objects, materials tools and projects. The design of GPWs should ensure functional and safe transition between different spaces for both users and devices. Thus, using double-doors opening in dual directions (double acting door) with glass inserted in both panels is highly recommended. It is also beneficial for moving large devices in and out of the GPWs. |

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| G73 | **Locate HPWs to adjacent outdoor area and allow integration between them** | Well designed outdoor areas should be planned as a natural extension for GPWs. Some activities such as building and painting which are best fitted with outdoor activity settings. Thus, the design of GPWs should consider locating them adjacent to outdoor area with special attention given to the transition space between them. |
| | ***Safety Consideration*** | **Reflection** |
| G74 | **Design SEL and GPW to meet safety considerations** | Hands-on activities spaces are the most spaces within school facility requires to meets safety provisions. These safety consideration should cover all safety aspects including: proper selection of building materials, finishes and furniture, providing energy and heat devices with automatic safety capabilities, availability of fire and some deduction systems, availability of smoke control and exhaust equipments, adequate design of emergency evacuation and exists. |
| | ***Storage Requirements*** | **Reflection** |
| G75 | **Provide suitable storage for SEL and GPW** | Storage requirements for SEL and GPW will be different. While SEL will consider safety as the main criteria, GPW on the other hands will require great flexibility to store various types of materials with different sizes. Both spaces will require great demand on storage spaces. There may be more than one form of it, for example: tool boxes, open or enclosed shelves, large or small cabinets, built-in or small room, or even refrigerators as the case in SEL. |

## 5.9 Creative and Conceiving Activity Setting, Implications and Guidelines

Designing a learning environment that stimulate creative thinking

### Finding Implications

| Scientific Experiments and Hands-On Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| The level to which the overall building design an its physical features stimulate creative thinking and the generation of ideas | **1.10** | Having a conventional school building will be difficult to spark students toward innovation and creativity. Even if the content and the process of the education have been changed, the physical environment may still bull students toward the old perception about education. |
| The overall interior design | **0.99** | Less opportunities to utilize the building as a teaching tool, less appreciation to the impact of the physical setting on the learning process by teachers and students, more probabilities to dislike the building which may influence academic performance. |
| The overall exterior design | **0.82** | It may have the potential to overlook the impact of the school in its community, and pioneer role of school as a symbolic of community development. |
| Availability of corners to stimulating conceiving thinking within the main learning spaces or around the supporting spaces | **0** | Potential to miss a crucial learning activity and outcome; which is creative thinking. Creative thinking is unusual thinking which is stimulated by having unconventional physical settings. |

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| Introducing new style of physical setting that are pleasant to students | **0** | As the result has shown, there are no such spaces in existing schools. Such spaces will have the potential first, to make students love their school, second, they will stimulate students to think in different way, which is encouraged for creative thinking. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| ***Exterior Building Characteristics*** | | **100%** | |
| G76 | **Design distinctive building form the importance of school in its community** | | Building form conveys a clear message to the community in which it is located. The level to which the design of the exterior is appreciated by the society is the level to which it is expected to make them belief the mission for which the building was designed for. If children are growing up in a community carrying this attitude about school, then it is more expected for them to value the activities taken place inside the building. This should be started from the location of the school by locating it in the heart of the community. Then, There should be something special in the architecture of the building so that its community can always indicate to this feature as a landmark or focal point for the community. Obtaining this doesn't mean each school building will be totally different from any other school. Sometimes, it may be achieved by having a flag pole that means something for the community. |

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| G77 | **Ensure architectural and aesthetic quality of building exterior** | It is important to maintain a certain level of building esthetics for the building to carries out the symbolic role in the community. There are unlimited ways to achieve this which will depend on the creativity of the architect. Some of the potential ideas can be implemented in the following aspects:<br>– Use of special architectural vocabulary and features<br>– Conscious selection of various building materials, finishes and colors<br>– Harmony of the school building with the surrounding<br>– Harmony of the various parts composing the school facility (Building massing)<br>– Subdivision of the building into smaller masses |
| ***Interior Characteristics*** | **100%** | **Reflection** |
| G78 | **Thoughtfully provide visual connection with the outdoors** | In addition to the healthy benefits of having window towards an open horizon, visual connection of the building to its outdoor, and to its greater environment 'the community' is a sensible evidence of the earning process taken place inside. The design should thoughtfully consider several means pertaining to make this connection, while – at the same time –respecting all social and cultural factors. For example, a project area could have a whole wall made of glass. For the students, it is a great opportunity to present their works (and consequently themselves) to the public, while for the community, it is clear evidence about what happens in the school. |
| G79 | **Design for plenty natural daylight** | Daylight is considered as the standard for color quality in lighting. It is also important because of the direct connection between daylight and the physiological well-being of human being. In addition, studies demonstrated a positive correlation between daylight and academic |

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| | | performance. The overall visual system of the school should be a combination natural and artificial light. |
| G80 | **Promote transparent interior design** | Transparency increases spaces brightness and the sense of openness which is important to stimulate students. In addition, providing transparency between activity settings and circulation enhance the walking experience through introducing a sense of drama while moving.<br><br>*Related guidelines about transparent interior design are provided under "Dynamic Learning Setting".* |
| G81 | **Create spaces that offer visual choice** | The design should provide areas within the school with different themes and styles instead of having one dominant mono-style. Providing a variety of style should be sought to attract different fancies and stimulating senses while moving throughout the school. Changing the floor and ceiling level is another way to add interest and dynamic to the space. |
| G82 | **Use of divers color, finishes and fixtures** | Using of multiple colors and finishes is the simplest way to make the learning environment interesting. It does not require heavy thought, applying a collection of colors with different finishes for wall surfaces, floors and ceilings. Also, providing more than one style of lighting fixture based on the nature of the function and the spirit of the space is a desirable and simple approached. |
| G83 | **Disperse technology all around the building** | Technology is a main heading for creativity. Fortunately, the new generation is 'enamored' of technology. Disperse technology elements in critical locations all around the school, or using it in the operation of the facility sparks students creatively and make them ready to think differently. |

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| | | *Relate guidelines are provided under "Technology-Based Activity Setting".* |
| ***Building as Textbook*** | | **Reflection** |
| G84 | **Design the school as an open "3D" textbook** | In an educational building, everything is information and information is about everything. The design should utilize the building and its components to provided real example illustrating educational concepts related to different subject. For example, a corridor may be constructed using an arch system consisting of brick units. The design of the arches should be made clear and exposed so that it could be used by the teacher as example of static physics. Or students can link what they learned in this course to the real life example. Similar approaches can be adapted with lighting and electricity, air-conditioning system, mechanical systems, and others. |
| ***New Learning Environments*** | **100%** | **Reflection** |
| G85 | **Introduce new learning environments that are pleasant to students** | Teens are more attracted to certain settings such as malls, coffee shops, outdoor and public settings. The design of the school could adapt some of the features of these spaces to introduce a new learning setting. Example of these alternative spaces can include:<br>– "**Learning Café** " (adapted from coffee shop, and used to stimulate discussions)<br>– "**Learning Street**" (adapted from public court, and used to stimulate social and cultural activities)<br>– "**Imagination Exhibition**" (adapted from public exhibition, and used to exhibit student inventions) |

| *Stimulating Spots* | | **100%** | **Reflection** |
|---|---|---|---|
| G86 | **Scatter stimulating spots in each setting** | | It is important when designing for creatively not to limits it in certain location or for certain times. No one knows exactly when a 'great idea' comes. Instead, the design should provide a 'stand-by' mode learning environment. So that when students or faculty need them, they will be activated and be ready to provide the potential they have. This will require the design to introduce some of these 'corners' within main learning spaces (classroom, laboratories, faculty area) or closely around them. For such spaces it is recommended to have informal settings with comfortable chairs and special finishes. Daylight and connection to the outside are important elements too. |

## 5.10 Technology-Based Learning Activity Setting, Implications and Guidelines

### Finding Implications

| Technology-Based Learning Activity Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| The level of using technology to increase the efficiency of operating the building | **0.58** | The poor score has ensured that utilizing technology in building operations is not considered. This will ultimately affect building performance in general and the ability to manage the facility effectively. It also will miss the opportunity to utilizing the building as a teaching and stimulating tool. |
| Availability of technical accommodations that support every day learning | **0.66** | Potential to lose the great benefits of incorporating technology in the learning process, increasing learning quality, classroom interaction, and promoting informal learning. |
| Availability of electronic networks (wired, wireless) within classrooms and the whole building | **0.37** | Very limited utilization of IT in the actual learning process as a result of limiting its use to very view number of persons in the school who may be even not related to learning. |
| Availability and quality of internet connection | **0.33** | Total loss of the potentials of the internet in education for both teachers and students. The World Wide Web has become ultimate source for learning. |
| Availability of advanced technology labs | **1.80** | The result has shown an average score of the availability of advanced IT lab. The more important is to operate these labs to obtain maximum benefits from them. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| ***IT and Building Operation*** | | **100%** | ***Note:*** |
| G87 | **Improving the efficiency of building operation by using technology** | | Many buildings' operational elements can be optimized by integrating technology to building system. Building acoustical and lighting systems, HVAC and energy conservation systems, communication system, and safety and security systems are all a potential areas where technology can effectively improve their performance. Moreover, the integration of technology to the performance of these systems will promote perceiving them as learning tools, or a "3D-textbook" learning environment. |
| ***Classroom Technology Accommodations*** | | **92%** | **Reflection**<br>The intention is to improve learning process in the classroom and enhance classroom interaction. |
| G88 | **Providing diverse types of computing and multimedia devices in the main learning space (classroom)** | | The architect should consider the design of "classroom" with great capability to accommodate variety of computing devices. Therefore, there will be a few desktop computers placed strategically in the "classroom" to be used for advanced work, for back up, or for students who don't have a notebook. Also, there will be many notebooks and Pocket PCs (almost one for each student) where students can use them anywhere in the "classroom".<br><br>*More guidelines are provided about multimedia devices under "Discussion and Presentation Activity Setting".* |

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| G89 | **Connect "classroom" computers to the school network and the internet** | The design should consider connecting the IT resources of the classroom beyond the walls of the classroom so that the "classroom" becomes the primary source of learning resources. Also, connecting students' stations with a LAN will greatly improve classroom interaction as many applications are available today to handle on-line forum. |
| ***Improving the functional performance of building spaces*** | **92%** | **Reflection**<br>The intention is to make all school physical spaces have educational value. |
| G90 | **Provide wireless local area network (LAN)** | First, it is mandatory to link the whole school IT resources with a robust network. Otherwise, a great opportunity to utilize IT is missed. Second, enrich this opportunity by using wireless network and mobile computing. This capability should be extend to the outdoor areas of the school. As a result, every setting within the school fences has the potential to be a learning setting. |
| G91 | **Connect school LAN to the internet** | Linking the school LAN to the World Wild Web (WWW) should be the next step in order to bring most of the educational resource to the school, and consequently to the hands of teachers and students. A fast internet connection should be made ready for the use of the students and teachers any and anywhere time they need. |
| G92 | **Dispersed technology elements over the whole school** | In addition to the use of technology for building operations, the design of the school should consider other forms by which technology is dispersed in the building. This may include selecting strategic locations such as main circulation nodes, the school entrances and lobby, or the central area of clustered spaces to provide quick-use computer standing stations connected to the school network. These stations could be used to search the acquisition of library materials, or |

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| | | | other information provided by the school. Other forms may be to provide a plasma screen to display school communication items, distinctive students' works, or scientific short multimedia program. |
| ***IT Advanced Lab*** | | **92%** | **Reflection** |
| G93 | **Provide advanced computer lab for specialized works** | | An Advanced computer lab will be needed to conduct specialize works such as Computer Aided Design (CAD) and graphics works. These activities require powerful computers which may not be available at "classroom" or supporting spaces. In addition, this facility may be required for community use, for example to offer short course in CAD. |
| G94 | **Provide a high-tech video-conference space** | | Online distance conferences are not new especially in real word business. A growing number of distance learning capabilities are provided today. Many of them are providing video-conference meeting, where the teacher and student(s) can see each other while communicating. School design should provide space on the school where teachers and students can communicate by sound and picture, or both of them can listen and see to an international speaker delivering a lecture from elsewhere. |

| *IT Support* | | 96% | **Reflection** |
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| G95 | **logistically support the use of technology** | | Having provided the main hardware and software of using technology, it is the time to supporting maintaining its using. In addition to the notebooks and Pocket PCs, students will need places to set and use them. The setting should be supported by stable power supply to ensure safe use of equipments. Also, it is important to provided sufficient electrical outlets for connecting devices to the power or for recharging them. In addition, the setting should meet basic visual and acoustical requirements discussed before. On the other hand, it is important to have an in-campus IT technician if a real IT utilization is sought. |

## 5.11 Social Learning Activity Setting, Implications and Guidelines

### Finding Implications

| Social Learning Activity Setting | Obtained Score (out of 3) | Implication |
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| Availability of spaces encourage informal communication between students, teachers and parents | **0.99** | Potential loss of positive school culture which positively enhances the dissemination of knowledge and the avenues of exchanging ideas. |
| Availability of social corners within the main learning spaces stimulating spontaneous interaction between teachers and students | **0.64** | Potential loss of positive classroom atmosphere where social norm is high. It will also miss the chance to break the artificial boundary between students and their teachers. |
| Utilization of in-programmed spaces (corridors, inner and outer courts, cafeteria) to encourage social learning and interaction | **0.64** | Potential to miss positive school culture, utilization of school spaces, fostering social interaction and promoting informal learning. |
| The level to which students feel belong to the school | **0.72** | Potential loss of interest toward learning as a result of feeling they do not belong to the space. Potential to have miss-behavioral actions (such as vandalism) from students' sides. |
| ***Relaxing and Refreshing*** | | |
| Availability of indoor and outdoor areas designed for breakout-times | **0.66** | Inadequacy of breakout spaces will have the potential to hinder students restore which may lead to increase the pressure on them and negatively influence their health and academic performance. |
| Availability of corners/nooks within main learning spaces support refreshing | **0.41** | Potential loss of interest as students are forced to follow prescriptive manner for learning without feeling they have options or the right to reactivate themselves to another mode of learning. |

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| Availability of exclusive recreational spaces | **0.00** | The result has shown that there were no such spaces. Such spaces will have the potential to publicize school to students, and to reduce vandalism behavior as it is a way to absorb teens' energy. |

## Proposed Guidelines

| **Proposed Guidelines** | | **Level of Agreement** | **Reflection** |
|---|---|---|---|
| ***Social Corner within Main Spaces*** | | **90%** | ***Note:*** |
| G96 | **Providing social corners in main learning spaces (classroom)** | | In addition to the overall design of the main learning space (classroom) that should consider the collaborative nature of the learning environment, it is highly recommended to have a small social area. A less formal setting –with comfortable chairs and round table fits into a colorful recessed place with special finish and decorations, and has a side window open toward outdoor landscape area –has the potential to make 180 degree change in the way students and teachers perceive 'classroom'. |
| ***Social Corner around Main Spaces*** | | **100%** | **Reflection** |
| G97 | **Providing social corners around the main instructional spaces (ex: classrooms, labs)** | | The intention of this is to provide spaces with double benefits, stimulate creative thinking and socialization beside active classroom and laboratories. The space will work best with cluster organization. |

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| | ***Utilizing Circulation: corridors and intersections*** | **98%** | **Reflection** |
| G98 | **Design corridor to be spacious and bright** | | For corridor and circulation to be conceived as social space, they should be first wide enough to allow something to happen rather than just moving path. Second; they should be brightened by natural daylight to bring life to it. This will set the as the 'background' or the 'infrastructure' for the corridor to work as a 'social artery' for the school. |
| G99 | **Meander circulation while maintaining supervision** | | If circulation is intended to be more than a path, designing it should not be limited to the traditional institutional-long corridor. Meander circulation creates opportunities for activities to happen and socialization to be fostered. In addition, it adds interest while moving. However, ensure transparency and introducing main nodes in the circulation will be helpful for supervision. |
| G100 | **Increase the functional value of intersection points by practicing various activities within them** | | In addition to the break of the long-boring corridor, nodes are intended to increase the functional value of the corridor. For circulation to be a social place, there should be something happening in it, and nodes are the most suitable place to do that. Nodes should be utilized to display students' works, to display scientific shows and programs, to accommodate food-trolley venders, to communicate materials between the school and students, and to install quick-use computer standing stations connected to the school network.<br>If some of these activates are planned to be conducted in some nodes, then, it will be very useful to treat their architectural differently. For |

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| | | example, they may have double height ceilings which will work as a vertical connection, and they may be provided with more natural light through windows, clearstory or skylight, and they may have more chairs and bench surrounded by landscaping features to enhance socialization. |
| G101 | **Provide seating in the corridor** | Although it may look normal to provide seats in the corridor, none of the four assessed schools have seats on their corridors. Providing seats in the corridors should be a basic thing to be done to enhance the social norm in the school environment. Arranging these seats in 90 degree angles will be helpful for socialization. However, designing the seating so that it accommodates a small group will turn the space into an informal learning place where peers are learning from each others. |
| G102 | **Provide cave space in corridors** | School should have space where individuals can learn by himself. A cave is nothing more than crannies, niches or wall recesses inserted on both sides of the corridor, or in any other space in the school. These spaces are very vital for individual to be alone for study, for reflection, for quite reading and for quality thinking. To grasp the feeling of containment, the place is needed to be enclosed from at least two sides. |
| G103 | **Empower the circulation by dispersing technology** | ***Related guidelines are provided under "Orderly-Configured Activities Setting*** |
| ***Cafeteria and break time*** | **99%** | **Reflection** |
| G104 | **Provide seats and tables for students to eat** | Provide a seat while eating is the minimum right students must be expected at school. Unfortunately, the common practice in all the assessed schools is to have a short break-time where most of the students barely find time to buy breakfast and quickly eat while he stands outdoors, whatever the weather situation. |

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| G105 | **Introduce various seating patterns for eating** | Similar to what are found in the malls and restaurants –which are the setting adolescents most preferred –school should have a variety of settings where they can eat. It includes having large group eat, small group, or individual seat. Eating seats are not limited only to chairs, usually students can sit in many surfaces to eat. Thus, the design of the school should consider this by thoughtfully developing architectural and landscaping details. |
| G106 | **Provide natural light, inner and outer views for eating spaces** | If eating spaces are intended to be utilized as an influencing social space, it should be designed to be attractive and have some level of esthetics quality. Providing natural light and views toward certain indoor and outdoor locations is intended to ensure the social value of these spaces. |
| ***Inner and Outer Courtyards*** | **98%** | **Reflection** |
| G107 | **Utilize interior court for socialization** | All the schools in Saudi Arabia are organized around large court in the middle of the school. In order to utilize these spaces the range of activities these spaces are intended to support should be identified. The common practice of providing a large empty space that is open from all directions should be avoided. A main issue to start with is to have a grid system by which the space could be virtually divided. Then, the entry and exit points should be clearly determined. A special consideration should be given to the way this spaces could be thermally acceptable. |

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| G108 | **Utilize exterior for courtyards** | | ***Related guidelines are provided under "Technology-Based Learning Activity Setting".*** |
| ***Exclusive Spaces*** | | **94%** | **Reflection** |
| G109 | **Provide large hall for socialization** | | Within large school (more than 300 students), School should have at least one large hall where at least 60 percent of students can be accommodated at one time. In the case of small population (less than 300 students), it is highly recommended to accommodate all the students. In addition to the social function, the hall could be utilized for many other activities.<br><br>*Further guidelines about multipurpose area are provided under "Flexible Activities Learning Setting".* |
| G110 | **Provide exclusive spaces for entertainments** | | Teens are full of energy that is sometime beyond formal learning capacity. In addition, they need time to be away from daily routine. Providing spaces exclusive for entertainments where students can for example play digital games, billiard, paper game; or any other form of entertainment will have the potential to consume some of their energy, enhance the social norm of the students, and even foster sense of belonging to the school. |

## 5.12 Flexible Learning Setting, Implications and Guidelines

### Finding Implications

| Flexible Learning Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Building ability to accommodate variety of activities and learning modalities | **0.67** | Inability to support variety of learning modalities which are necessary to implement learner-centered learning. |
| Ability to modify spatial capacity of the space, its configuration and the way it is arranged | **0.98** | Less flexible and dynamic learning spaces that will cause difficulty to transform from one learning mode to another, which is required as students are expected to engage in a variety of activities. |
| Level to which inner and outer courts are utilized in doing educational activities | **0.96** | Less utilization of school spaces that will lead to ignoring large spaces. Also, a loss of introducing new learning settings which is a healthy practice to enhance learning experience of the students. |
| Ability to accommodate future changes (users, curriculum and learning strategies, technology, and the relation with the community) | **0.79** | Rigid building that is resistant to change, and incapable to cope with educational emerging needs and society expectations. |
| Availability of large hall(s) for multi-purpose uses | **1.05** | Fewer opportunities to organize activities/events that could accommodate most of the school users or community participation (ex: social and extra-curricular activities). |

## Proposed Guidelines

| | Proposed Guidelines | Level of Agreement | Reflection |
|---|---|---|---|
| | ***Meet General Requirements*** | **100%** | |
| G111 | **Design school based on similarity of function not differences** | | The design of the school should be based on the similarities of the intended activities rather the differences among them. Design school based on differences tends to determine the function first (not the activities) and then, design the space for that particular function. This will result in an isolated space that is reluctant to other spaces. The final result of this is a rigid building that is resistive to change. However, design school based on similarities tends to identify areas of overlap between different functions and start from them to design the space and the whole school. Thus, the school as a whole is designed based on integrative and dynamic settings. As a result, the school becomes more responsive to change. |
| G112 | **Provide specious spaces** | | One way to ensure school flexibility is to design certain spaces for general multi-purposes. These spaces or "halls" should be spacious and with minimum permanent structure in the middle. The space should be planned based on the range of the activities it is intended to support, in addition, it is design should anticipate future needs so that there will be a margin for future uncertainty.<br><br>*Related guidelines are provided under "Social Learning Activities Setting"* |

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| G113 | **Apply flexibility at different levels** | Flexibility should not be sought only at large spaces or for certain functions. It should be applied at all level in the physical setting. Flexibility should start from individual workstation where individual should be capable to perform various activities. Then, it should be applied at group level where more than one learner is engaged collaboratively in many activities. Then it should be applied to the "classroom" settings where diverse activities are conducted by several groups of learners, and so on. While the concept is the same, the details will be different from one level to another. |
| | ***Accommodate Future Changes*** **99%** | **Reflection** |
| G114 | **Arrange spaces around the activities expected to continue in the future** | Recent research and real experiences have ensured that curriculum is not a reliable base for designing the school. Thus, to design flexible school it needs to identified the functions or activities that are most probably will continue in the future, at least the near future. Then, arrange school spaces around these activities. Such activities include collaborative work, project-based work, independent study, presentation and discussion and hands-on work. |
| G115 | **Design school to allow orderly growth** | Looking to the school as a whole, strategic planning of the school should consider how the school can be expanding in the future without having anomalous facility. This expansion should be part of the strategic plan of the school that is prepared based on extensive studies and genius manner to outlook to the future. Therefore, the design should generate alternative solutions guided by the strategic planning. In the other hand, designing the building with more than one mass will make it easier to add more masses in the future if needed. |

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| G116 | **Design school for evolving educational philosophy** | Already there are many ideas about education set by many philosophers. Some of these ideas are well established while others are still under debate. For school design, it does not have to have all these ideas, but it is always good to have the good things in these ideas. The best way to avoid having an obsolete building is to avoid design decision based on unreliable base or changeable educational components. |
| G117 | **Design school to be economically adapt to program changes** | The academic program is continually evolving as the demands of the time change. Thus, designing for specific program may work well for a period of time, but it will be very difficult for the building to adapt to change when it become mandatory. Actually, academic programs should never be the initiative of school design. |
| G118 | **Design school for changing societal needs** | Societies have being changing, and consequently their demands are changing. What is debated today may become resolved in the future. For example; although the concept of community school is adapted globally and even is evolving to new concepts, the concept is not adapted at all in Saudi Arabia without clear justifications. Thus, the school design should consider such concepts even if it is not adapted currently. |
| ***Accommodate Divers Activities*** | **99%** | **Reflection** |
| G119 | **Design school to allow divers Pedagogy and various learning styles** | There are many teaching strategies and methods by which teachers deliver learning to students, and there are many ways or styles students prefer to adept in order to learn. The school design should accommodate as much as possible of them. The most successful school is the one that can accommodate the greater number of them. |

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| G120 | **Design school to serve many functions and activities** | | School should not be a place to develop academic skills only; it is also a place to develop skills for life. School should be also a place for the whole community. The common practice of design most of the school building based on one function, and even dominated by one activity, which is memorizing, should be avoided. |
| | ***Modify Space*** | **100%** | **Reflection** |
| G121 | **Ability to modify space capacity and configuration** | | A clear example of such strategy is the way halls are configured in hotels. In hotels, the halls sizes and even their geometry can be modified based on the number of users and the intended activities. This is achieved by using movable walls and partitions with certain acoustical specification. The same thing should be adapted in school. It is recommended to apply this strategy in design for "classrooms" as they are basic unit composing the school. If the basic unit is flexible, then the overall building will be so. |
| | ***Utilizing Un-Programmed Spaces*** | **97%** | **Reflection** |
| G122 | **Utilize indoor and outdoor courts** | | When designing school spaces –especially large spaces such as halls and workshops –it is recommended to attach them to open areas either indoor or outdoor, with the capability to join the two spaces together. This will greatly increase the flexibility of the space, and in addition it will add interest to the whole environment. On the other hand, inner courts should be utilized for its self potentials. Large indoor court should be shaded and well identified so they do not become abstract space. Similar things should be considered with outdoor courts. In addition they should be designed as a natural extension of indoor spaces. |

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| | | | *Related guidelines are provided under "Social Learning Activities Setting"* |
| ***Flexibility of Building Systems*** | | **100%** | **Reflection** |
| G123 | **Ensure flexible and adaptable building system for current and future demands** | | As school should be primarily designed to accommodate a variety of activities and based on changing demands of changing people, flexibility of school building systems has become a urgent concern. For example, the structural system should allow flexibility to change spaces volume, configuration and layout. The lighting system should allow combination of natural and artificial light and the ability to control light based on environmental changes or changes in activity. It should also provide more than one option for the users. HVAC system should be capable to do its function as the activity changes and the configuration of the space changes, and so on with other systems. |
| ***General Purpose Storing*** | | **94%** | **Reflection** |
| G124 | **Provide enough general purpose storage** | | Although the experience has ensured the need for general storage space for school, this matter has been ignored. If the conventional school demands general storage, it is expected that the demands will be much higher in future schools, as the activities and the roles of school will be much more. General storage will be sought for each group of classrooms, or what is identified as the "learning academy". Also, the school as a whole will need a large general storage space. In addition, school facilities that would be used by the community will also need a general storage space. Thus, it is important how to layout school spaces based in its function and users types so that storage spaces are assigned for each zone. |

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| ***Flexible Furniture*** | | ***Added*** | **Reflection** |
| G125 | **Provide flexible and maintainable furniture**<br>**Add from inspection** | | Flexible furniture is a key element to having a flexible learning environment. Flexible chairs and table are the one that can be adjusted to the user's dimensions and his preferred style. There are also the one that can be moved easily. Tables in particular have to be of great flexibility. They should be easily configured in different shapes to suite the indented activities.<br>Other criteria that should be considered when selecting furniture include:<br>– Durability of materials<br>– Resistance to vandalism<br>– Easy to clean<br>– Easy to fix<br>– Aesthetics quality: Finish, Design and color |

## 5.13 Community Related Learning Setting, Implications and Guidelines

### Finding Implications

| Community Related Learning Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Level of which teachers and students benefit from community facilities | **0.62** | Miss the opportunities to benefit from community facilities that may not available in school, duplication of facilitates (wasting of resources), loss of potential benefits students obtain as a result of the direct involvement in real life practice. |
| Level of which the community benefit from school facilities | **0.65** | Miss the concept of community school which will lead to duplication of facilities, and deemphasizing the role and impact of school in its community. |
| Availability of spaces designed to accommodate social activities where parents and different community groups are expected to participate in addition to teachers and students | **0.66** | Less capability to organize large community events that have the potential to promote the social norm in school and strength the relation between the school, the parents and community at large. |
| The relation between the school facility and its urban environment in which it is located | **0.81** | Inability to fit in harmony with the community environment, which may imply incapability of the school to reflect social/cultural values and community expectations. |

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| *General Concept for Interchangeable Benefits* | | **99%** | |
| G126 | **Locate the school in the heart of the community** | | If the school is to be a community school, it should be located close to the people it serves. Community school is intended to serve all the categories composing the society. This includes children, adults and elderly people. Thus, the facility should be fairly located so that people can reach it by walking. |
| G127 | **Design school to work for 12 hours daily, 7 day weekly all around the year** | | As many categories will be served by the school including young teens, employee, and retired people, and as school will be considered as a valuable asset in the community where it offers knowledge, community services and recreation, they should be designed with maximum possible utilization. |
| G128 | **Avoid duplication of facilities with the community** | | A community school is a valuable asset for all members in the community, not only emotionally, but because it provide direct service to all the members of the community. Thus, the planning and design of a community school should involve as much as possible community partners. For example, municipalities should be involved directly in the process, and identify –with the school district –the potential area where facilities can be shared. If the district library to be used extensively by the school, there is no need to build large library in the school, and vice versa is true. Another example is the sport fields provided by the municipality in each districts. Through partnership and good coordination, community schools could be built adjacent to these field and utilize them. |

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| ***Strengthen the Relation between the School Facility and its Urban Environment*** | | |
| ***Exterior Features: Welcoming School*** | **100%** | **Reflection** |
| G129 | **Ensure easy access to school** | Accessibility starts from selecting the proper site for the school. Some of the site selection criteria include avoiding closeness to unsafe pedestrians area (heavy-traffic highway, industrial and workshops courts), and low population area. Accessibility is also meant by providing sufficient parking for users and visitors, and ensuring paved pathway from the surrounding environment to the school so that students and community members can come to school by walk or riding bicycle. |
| G130 | **Avoid high-solid fence of the school** | High-solid fencing conveys a negative relation between the community and the school. In addition, it develops a sense of in-trust between the students and the school as they feel they are in a prison. In a real example; a transparent school fence for a school was replaced by a high-solid one. Actually, a transparent fence is more secure than solid one if the school is designed and operated as a community school. While nobody can see what is happing behind high solid wall, transparent fence will provide many "eyes on the street". |
| G131 | **Design outdoor area for community use** | Design outdoor areas and sport courts for community use after school is the basic form of the true relation between the school and the community. In addition, the people who use school outer courts are the school's students. Moreover, because these activities are usually conducted after the end of school day, they do not conflict with the school activities. Thus, the design of the school should separate the use of outdoor landscape and sports courts from the use of the indoor spaces of the school. |

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| G132 | **Design school building as true symbolic of the community** | In its optimum model, the community school may be the most used building by the all people composing the society. Community school becomes the nucleus source of community development communicating its original values. Thus, the design of such building should reflect its value in the society, and consequently should be designed as a focal element in the community.<br><br>*Related guidelines are provided under "Creative and Conceiving Activity Setting".* |
| G133 | **Suitability of school architecture to the urban and demographic environment of the surrounding** | In addition to design the school building with distinguished architectural, it should go in harmony with the architecture of its community. Thus the design should Incorporating some of the community architectural characteristics and formed in new way conveying that the school is the community bridge to the future. |
| G134 | **Prominence of main entrances of the school** | Entrances are the first point of penetration of the building. It is where the first impact is developed. The school entrance should be designed to be a welcoming place. It should be made clear, wide and transparent. Even if it is difficult to see the gate from any location, the building form and massing should convey the location of the main entrance. |
| ***Interior Features*** | **98%** | **Reflection** |
| G135 | **Providing spaces designed to receive visitors** | School design should provide place where visitors can get information about various issues either related to their kids or related to the services provided to the community. The place should be with direct relation to the main entrance. It is also highly recommended to have a lobby setting adjacent to the reception desk. |

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| G136 | **Clear identification of public and private use of spaces** | It is important to clearly identifying activity zone based on the type of users. This is to ensure that community use and academic use are not overlapping, which is not recommended.<br><br>*Further guidelines are provided under "Orderly-Configured Learning Setting".* |
| G137 | **Provide space to initiate community dialogue about education** | As parents and visitors are welcomed to be in school, it is highly recommended to expose visitors to the work of the students. This is intended to clearly show how students' are engaging in learning process. Thus, the design of the school should consider increasing interior transparency of the building –especially toward active spaces –and provide various places to display students' works. |
| G138 | **Providing spaces designed to accommodate social activities with the community** | In addition to the main seasonal events such as parents council, there will be increasing activities attended by the community. Thus, school facility should provide spaces designed to accommodate social activities where parents and different community groups are expected to participate in addition to teachers and students. |

## 5.14 Orderly-Configured Learning Setting, Implications and Guidelines

### Finding Implications

| Orderly-Configured Learning Setting | Obtained Score (out of 3) | Implication |
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| Clarity of arrangement of facility spaces in terms of the type of use (private/public/mixed) | **0.60** | Unclear determination of the boundary of zones based in which different categories of users can work smoothly. This will have the potential to produce a circulation problem, conflict of use and security concerns. |
| The way the building is divided into smaller units | **0.94** | Difficult to trace plan, inefficiency in translating functions into physical settings, and more potential to miss the sense of belonging to the spaces as individuals are lost in large building. |
| Closeness of supporting spaces to the main learning spaces, and the level of integration between them | **0.93** | Inefficient space relationship which will have the potential to affect the frequency and the pattern of use for certain activates. |
| Location of common facilities and school administration | **0.92** | Poor layout arrangement of key functional spaces that will have the potential to affect the pattern of use and the relation between the administration and the users of the building. |
| Closeness of teacher area to students work areas | **0.71** | Poor lay out arrangement and spaces relationship between two main parties of learning process: teachers and students. This will have the potential to weaken the relation between them, and will reduce spontaneous meeting of teachers and students. |

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| Integration between indoor and outdoor environment | **0.71** | Missed utilization of large spaces within the school facility. Miss the opportunities to extend the learning process outside the boundary of enclosed spaces. Miss the opportunities to introduce new learning environments. All these will have negative impact on disseminating positive learning environment. |

## Proposed Guidelines

| | Proposed Guidelines | Level of Agreement | Reflection |
|---|---|---|---|
| | ***School Zoning and Relation*** | **100%** | |
| G139 | **Clearly arrange school's spaces in term of user's types** | | The school design should organize the layout of the spaces so that each school user groups can easily identify their intended space. The organization should include: private use; exclusive for students and teachers. Public use; spaces intended basically for the use of community, and shared use; spaces intended for both the private and public. |
| G140 | **locate common use spaces at strategic location** | | Common and shared spaces such as the library and the administration area should be located to be equally accessible by all users in the school. It should be considered that while some spaces will be related to the whole school such as administration, there will be other spaces that should be related to a part of the school, which is intern related to the school as a whole. This is important when dividing school into smaller units. |

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| G141 | **Ensure close teachers work space to students activities spaces** | Teachers workspaces should be related to the areas where students will be actively engage. This is to ensure that teachers are always close to provide help and to have "eyes on the street". Thus, the school design should consider providing more than one area for teachers' workspace. Teacher can be grouped either based on area of specialization, or to form multi-disciplinary teacher space which is highly recommended for project-based. |
| ***Dividing School into Smaller Units*** | **99%** | **Reflection** |
| G142 | **Dividing basic learning space (classroom) according to nature of the intended activities** | The basic learning space (the classroom in conventional model) should be designed to accommodate variety of activities. Thus, the spaces should be organized to have: Active zone; includes project setting, Display zone; includes presentation and discussion setting, production zone, includes individual and teamwork setting, social zone; includes breakout and thinking settings. The area of each of these settings should be clearly identified so that each function within "the classroom" can be conducted without interfering with other function. |
| G143 | **Introduce a hierarchy of spaces relationship** | Hierarchy of spaces and settings is intended to break the large institution into more easily comprehended and personalized parts. Through the hierarchical grouping, learners are stimulated to be part of a smaller group that is related to a lager subpart of the whole. The attention of dividing the school should be to make it visible to provide a full curriculum without losing the individual student in the large mass of the students. |

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| G144 | **Consider individual as the basic unit in designing the school: Individual Setting** | In contrast to the conventional school model, learner-centric approach considers the individual to be the basic unit the physical environment should support. Thus, workstations of the individual should be designed to allow individuals doing more than one tasks. In addition, the station should satisfy individual basic needs. |
| G145 | **Group individuals in small collaborative setting: Group Setting** | A small setting should be provided to contain two to six learners working in collaborative manner. The setting should be design to facilitate various form of learning. This setting should represent the basic from of mature collaborative work. |
| G146 | **Cluster "Group Setting" in a familiar-based setting: Family Setting** | Two to three small groups can be clustered around a common area to form a familiar-based group. The recommended number of the learners within the familiar group should exceed twenty students. This setting is equivalent to the "classroom" setting in the conventional school model. The overall setting should be provided with the required resources to be an efficient collaborative and productive setting. It should also facilitate inter- disciplinary teaching. However, the central area within this setting is of high importance. It should be design to accommodate social interaction or as a common project-based setting. It should also contain the shared resources such as presentation and discussion requirements of the family group. |
| G147 | **Arrange "Family Settings" to form small learning communities: Community Setting** | Several "Family Settings" can be organized to compose learning academy. Each academy is recommended to contain between 100 to 150 students (Nair: 2005, November). The community should have a unified elements shared by all the families. This level –except for few specialized spaces –can function as stand-alone high school. |

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| G148 | **Link "Communities" to form a neighbourhood: Neighbourhood Setting** | Two or three small communities can be organized to share specialize areas and a common space for large assembly events to from a neighborhood. The neighborhood represents a complete high school facility. Multiple neighborhoods can be repeated across a large area to compose a schools complex. |
| ***Extend Activity beyond Space Boundaries*** | **94%** | **Reflection** |
| | **Related guidelines provided under "Effective Circulation: Dynamic Learning Setting, and Social Activity Setting"** | |

## 5.15 Effective Circulation: Dynamic Learning Setting, Implications and Guidelines

### Finding Implications

| Effective Circulation: Dynamic Learning Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| ***Within overall School Facility*** | | |
| Capacity and adequacy of entrances and inner corridors | **1.40** | Inadequate circulation system that will affect circulation pattern. Fails to comply with safety provisions with regards to emergency paths and means of exist. In ability to utilize main corridor as a social 'artery' of the school. |
| Easiness to understand and remember circulation paths (specially for new visitors) | **1.49** | Difficulty of finding your way which may discourage parents and other community members to visit the school. |
| Staircases locations and adequacy | **1.10** | Poor compliance to safety provisions. Inadequacy to accommodate students' movement especial at peak period. Miss utilization of staircase as a mean to connect spaces and functions through direct vertical connection. |
| ***Within Main Learning Spaces*** | | |
| The way in which the main learning spaces are divided to accommodate variety of activities (active zone, individual and team work areas, presentation and discussion area, quite area) | **0.58** | Very poor space layout that will lead to poor space utilization and incapability to accommodate a variety of activities. |

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| Circulation within main learning spaces (classroom, labs, learning resources, other) | **0.87** | Interrupting learning process, and hindering the utilization of the space to accommodate more than one main learning activity. |
| ***Outdoor Circulation: Vehicles and Pedestrians*** | | |
| Site and outdoor paths * | **1.23** | Less utilization of outdoor spaces for both school users and the community. |
| Vehicle circulation* | **1.32** | Potential safety hazard and increasing traffic jam, which will cause access difficulty and may discourage community use of the school. |

***: *It means the element was evaluated based on several criteria. See Inspection Form.***

## Proposed Guidelines

| | **Proposed Guidelines** | **Level of Agreement** | **Reflection** |
|---|---|---|---|
| | ***Capacity and Adequacy of Entrances and inner Corridors*** | **90%** | |
| G149 | **Ensure adequate movement paths** | | The design of the entrances and corridor should take in consideration the following:<br>– Spaciousness of school entrances, especially the main entrance.<br>– Availability and spaciousness of entrance foyer<br>– Spaciousness of circulation paths, specially main circulation, and the reduction of minor intersections |

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| | | – Shortening of long corridor by introducing main circulation nodes<br>– Meet Safety Considerations |
| G150 | **Design circulation to meet safety requirements** | Design for safety should always be the case in school buildings as they contain large number of users. Main safety issues that should be considered by the design include: emergency exists (quantity and quality), travel distance, protection of horizontal circulation (especially from smoke), vertical circulation protection, non-slippery floor finishes, emergency signs and light and avoidance of dead-ends paths. |
| ***Dividing Main Learning Space*** | **100%** | |
| | **Related guidelines provided under "Orderly-Configured Learning Setting_ Dividing School into Smaller Units"** | |
| ***Circulation within Main Learning Space*** | **92%** | **Reflection** |
| G151 | **Identify clear movement pattern within main learning spaces** | When preparing the layout of the main learning spaces the following points should be considered:<br>– Reducing moving paths within each function, and identifying them clearly between different functions<br>– Arranging teamwork stations in cluster form, related from within and interconnect with other clusters<br>– Locating activities involving the use of large equipments to the side of the space and close to the walls |
| | **Related guidelines provided under "Orderly-Configured Learning Setting"** | |

| *Functional Integration and learning experience* | | **90%** | **Reflection** |
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| G152 | **Design circulation to integrate between different activities settings** | | Circulation is a key element to achieve integrated activity settings. To achieve this integration, circulation should not be perceived only as passages between main settings. They should be designed as a transition area, where one mode of learning ending and other mode will be stared. Thus, the design of circulation should allow the extension of the activities took place in the main learning settings. |
| G153 | **Design circulation to accommodate learning activity** | | Circulation can be more than a transition space, they can accommodate main learning activities. For example, the main intersection located in a quiet zone could be enlarged and stepped down to have a lower level than the main circulation, and equipped with an overhang projecting surface and overhead projector, can be an excellent setting for presentation and discussion. |
| G154 | **Design circulation to foster social interaction** | | Circulation may be the best place in the school to foster social interaction. Within circulation a lot of conversations, spontaneous meeting, and in formal learning are took place. The circulation should be designed to facilitate and enhance these activities.<br><br>*Related guidelines are provided under "Social Learning Activity Setting".* |
| G155 | **Design circulation to enhance learning experience** | | Changing environment is one of the means used to stimulate thinking. Circulation routs can be the best place to dramatically introduce these changes. First; circulation should be designed with rich details; use of different colours and finishes, different light fixtures, different levels and varied ceiling height. If is not possible to widen, at least it should be done at certain locations in the circulation. Second, circulation should be designed as if you were penetrating through |

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| | | knowledge, similar to circulation paths in museums and exhibitions. This could be achieved by promoting transparency within the interior design of the school.<br><br>*Related guidelines are provided under "Creative and Conceiving Activity settings".* |
| ***Easiness to Understand and Remember Circulation Paths*** | **98%** | **Reflection** |
| G156 | **Design circulation to be simple and easy to remember** | Simplicity should be the main feature of circulation. Simplicity in circulation should be considered to ensure comprehended and easy to use paths. Thus, the design of the circulation should avoid narrow hidden corridors and too many minor corridors. |
| G157 | **Use comprehensive signage system though out the whole building** | It is always beneficial to have signage system guide you over the whole building, especially with complex building. Signage system is very important for people visiting the school for the first time or those with frequent use. |
| G158 | **Introduce main nodes to the circulation** | Too long corridors are boring and institutional looking. Introducing main nodes into the main corridor modify the length of the corridor, and allow something worth to happen on them. In addition, they work as a reference point especially for those who do not use the facility frequently. It also controls the movement patterns in the circulation. |

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| ***Staircases Locations and Adequacy*** | | **94%** | **Reflection** |
| G159 | **Provide sufficient and wide staircase.** | | Staircase was one of the main aspects which received dissatisfaction from the users of the schools assessed in this study. Staircases should be designed to accommodate maximum number of users, not the average. The number of staircases and their location should be thoughtfully decided as they are related to safety. |
| G160 | **Strategically locate staircases** | | In addition to the safety consideration, there are many potential benefits of staircases. A staircase is usually the main vertical simulation in school. Thus, the concept of integrated setting though using horizontal circulation is also applicable with vertical circulation. For example, the transition area between two activity settings can be happened in the landing deck of the staircase. The Staircase is also links main space in the second floor that is frequently used to the main entrance. It can be used also to attract attention to certain spaces in the building. In addition it is a vital tool to bring natural light over the whole height of the building. |
| ***Outdoor Circulation: Vehicles and Pedestrians*** | | | |
| ***Vehicle circulation*** | | **Added** | ***Note**: the element was assessed by the users, but the guidelines were not exposed to them.* |
| G161 | **Ensure safe vehicle circulation around school** | | The school site is a point of traffic jams especially at two periods, in the morning when students come to the school, and in the afternoon as students leave the school. Thus, there may be a potential of accidents hazard for vehicle as well pedestrians. The design of vehicle circulation around the school should consider the following:<br>– Consider busy period & traffic jams<br>– Consider pedestrian movement and intersections |

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| | | – Enforce slow vehicles motion<br>– Equipped with traffic signage system<br>– Separation of bus, car and services circulations and parking<br>– Provide Safe drop area away from the main street |
| ***Site and outdoor paths*** | **Added** | ***Note**: the element was assessed by the users, but the guidelines were not exposed to them.* |
| G162 | **Provide adequate outdoor paths linking the school with its surrounding and within the school outdoor area** | Outdoor areas should not be forgotten without paths, as the case with most of the assessed schools. When designing school outdoor paths, the following should be considered:<br><br>– Connecting the school to the surrounding neighborhood and buildings by paved paths<br>– Safe pedestrian crossovers through limiting transition points and provide suitable protection<br>– Direct connection between parking and entrances<br>– Main transition zone between outdoor and indoor with no vehicle movement<br>– Sufficiency of walkways within outdoors areas<br>– Shaded outdoor walkways within the school backyard specially those main paths that link the main building to other school facilities or those used extensively<br>– Shaded setting spaces along walkways |

## 5.16 High-Operational Performance Learning Setting, Implications and Guidelines

### Finding Implications

| High-Operational Performance Learning Setting | Obtained Score (out of 3) | Implication |
|---|---|---|
| Natural lighting and ability to have control over it | **1.25** | Either failing to use it which will have the potential to increase energy consumption, and missing its potential benefits to improve students' performance.<br>Or does not having control over it which will cause sight difficult such as glare affect and the using of computer and IT resources. |
| Artificial lighting and ability to have control over it | **1.60** | Potential visual problems (e.g.: inability to see clearly, or excessive light level or intensity and glare affect).<br>Potential health problems (such as headache and eye pain). |
| Ability to overcome exterior noise | **1.24** | – Inability to concentrate.<br>– Possibility to lose students interest<br>– Potential of hearing health problems |
| Ability to overcome noise from within the building | **1.04** | |
| Ability to overcome noise from within the classroom | **0.08** | |
| Ability to provide appropriate room temperature all around the year * | **1.21** | Uncomfortable thermal setting that may cause to loss of concentration and interest, in addition to potential health problems. |

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| Quality of indoor air particularly within classrooms * | **1.13** | Inadequate air quality that will have the potential to cause sleepiness, lose concentration, dizziness, in addition to health problems especially people with asthma. |

***: *It means the element was evaluated based on several criteria. See Inspection Form.***

## Proposed Guidelines

| Proposed Guidelines | | Level of Agreement | Reflection |
|---|---|---|---|
| ***Lighting Performance*** | | **98%** | |
| G163 | **Design school with daylight as the main source of light** | | Natural lighting during daylight hours should be the major source for lighting the school. When designing for natural light in hot weather areas, the design should considering implement both art and science. The concern is not only to provide ample daylight; it is the balance of doing that without any side effects including heat loss and gain, and the quality of the obtained light. |
| G164 | **Ensure obtaining "cool daylight"** | | The concept of "cool daylight" is concerned about obtained quality natural light avoiding undesirable effects. The design should apply this concept for all sources of daylight including side window, clearstory window and skylight. Cool daylight is ensured through a combination of glazing systems with low solar heat gain coefficient, shading system, and architectural design. |

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| G165 | **Supplement nature light with diverse artificial light** | When daylight is dim, or it could be associated with undesired effects, it should be supplemented by artificial light. When providing artificial light, the design should consider its energy efficiently, its life long and maintenance requirements. Generally integrating natural light and artificial light will have positive impact on the overall visual performance of the facility including cost saving. |
| G166 | **Balance direct and reflected light** | Often it is recommended to obtain reflected light. Reflected light is more diffused and has less side effects such as too brightness and glare-effect. School design should provide the means by which light –either natural or artificial –will be reflected. In some exceptions, directed light will be needed such as for working with tiny objects. |
| G167 | **Provide control over light source and lighting level** | In school building, light is needed for diverse activities. The amount of light will vary greatly depending on the type of the intended activities. While general work such as reading and writing requires less level of light, detail activities will requires higher levels. The extensive use of computer and IT resources will require different types of lighting. The user should have the capability to select the type of lighting best suited to the activity they engage in. For natural light, it is preferred to have the window on either sides of to the activity rather than opposite it or be in the back of the activity. For artificial light, the design should provide wide range of light fixtures including general and task lights. |
| G168 | **Use full-spectrum light** | Natural light is considered the reference of measuring the quality of the light because it has continuous spectrum of all light wavelengths: blue, red and green. Therefore, the best artificial light is the one that has the closet characteristics of the natural light. Full-spectrum light is defined as a lamp having a Color Rendering Index (CRI) of 90 or above, and a color temperature of 5000 |

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| | | degree Kelvin or above. Combining Full-spectrum with polarizing lenses to filter the light will result in great artificial light performance. |
| G169 | **Design light for visual amenity avoid uniform light distribution** | In addition to the functional part of the light, it is a powerful element to introduce interest and beauty to the spaces. Visual amenity is a result of a balanced composition of light and shade. The first step to achieving that is to avoid having uniform brightness level, which is undesirable even for healthy considerations such as tiredness and lack of attention. |
| ***Acoustical performance*** | **98%** | **Reflection** |
| G170 | **Design school with minimum exterior noise** | Exterior noise is directly related to the location of the building and the contextual environment in which it is located. Airplane, train, buses and vehicles traffic are some of the main generator of exterior noise. The process of school site selection should consider noise as one selection criteria, and should avoid main sources of noise. |
| G171 | **Design learning settings with minimum background noise** | Building system is the major source of background noise. In particular, heating and cooling system (HVAC) and light fixtures are the most leading source of background noise in classroom. The maximum allowable background noise level in classroom is 35 dB. The selection of building systems should be based on their specifications that should ensure low noise performance. |
| G172 | **Design learning settings with minimum interior noise** | Sources of interior noise generated in learning settings are students talking, books and paper shuffling, and chairs and disks sliding on the floor. Because this type of noise has frequencies close to the teacher's voice, they are considered the most harmful to the learning process. Thus, the school design should consider the approaches |

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| | | by which the physical settings reduce noise generated from within. For example; the workstation deck should be selected based on its shape and finish that are better at absorbing to sounds, similar things with other setting's components. |
| G173 | **Design learning settings for suitable reverberation time** | More reverberation time means more noise level within the space. The recommended reverberation for learning setting is 0.4 seconds. If it is known that each doubling of distance reduces the signal strength by roughly 6 dB, and any sound reaching student's location in the classroom is a combination of direct and reflected wave of sound, in addition, each material has different sound absorption capability (based on its absorption coefficient, α), the design practices of school should consider space volume, proportion, geometry and finishes to ensure suitable reverberation time. |
| ***Energy Conservation and Thermal Performance*** | **98%** | **Reflection** |
| G174 | **Suitability of the site and building orientation** | The way the building footprint is orientated in the site has great impact on the thermal performance of the building. The building envelope is a combination of different materials and systems that will have different thermal characteristics. Architectural details are the final touches that will influence how the building envelope interacts with site and the environmental parameters. As a first step in this hot and humid region, the main building axis (the logiest side of the building) should be extended in the east west direction. This will protect the building from direct sun rays coming from the east at mooring, and the west at afternoon which is more difficult to control. While the other axis, the shorter one, should be extended on the north south direction. This will reduce the south facade of the building that could be |

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| | | controlled by using horizontal shading. Other strategy to be implemented is to locate some of the utilities or less used spaces so that they expose to direction. For example general storage space can be located in the south facade of the school. |
| G175 | **Use of proper building thermal materials and installation** | Use of effective thermal building materials should not be an extra feature. In addition to the functional and behavioral benefits users will experience, building envelope is directly related to maintain the radiant heat component under control. The thermal characteristics of the building materials and the way they are constructed are directly related to the performance of the HVAC system, and thus they have great cost impact. |
| G176 | **Maintain operative temperature within comfort zone** | Operative temperature considers both convective effect and radiant effect (heat transfer to and from interior surfaces). In relation to other thermal parameters, operative temperature should be maintained between 20°C and 25. °C. Studies indicated that people begin to sweat at 25.5°C ET and find it difficult to maintain moderate work at 26.6°C ET. |
| G177 | **Provide uniform temperature** | Variation in temperature between human head and foot is a cause of uncomforting. ASHRE standard recommended a variation limit of 3.6°F for seated person and 5.4°F for standing one. The design of the school should consider the location air outlets/units and the space shape and volume to ensure acceptable variation level. |
| G178 | **Consider variation of activities (metabolic rate)** | Various functions are conducted within school buildings that are widely differ in term of the required human activity levels (metabolic rate). The activity level is a main influencing factors in determining the comfort zone of for the intended person. Thus, the design practices should consider the activity level associate with the intended function in specifying the HVAC system of the |

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| | | activity setting. |
| G179 | **Limit the effect of humidity** | Based on many studies, the humidity ratio is one of the main parameters affecting learner performance including: concentration, sleepiness, vigor, social interaction and elation. The indoor space should be maintained to a humidity ratio below 0.012. For indoor conditions of 23.9°C and 25.6°C, with maximum relative humidity (RH) level of 65% and 59%, respectively. Thus, the HVACH system should be capable of maintaining recommended parameters through the process of humidification and dehumidification. |
| G180 | **Maintain suitable air velocity** | Air velocity is one of the components that are related to the overall thermal comfort. Within the learning settings air velocity should be considered with reference to other thermal parameter. For example, if the room temperature is relatively high, it would be preferable to provide higher air velocity, and vice versa. The maximum allowable air velocity within an occupied indoor space should be maintained below 40 feet per minute (fpm). For naturally ventilated spaces, air velocity is allowed to be increased so it increases heat loss by skin. Thus, in addition to the capability of the HVAC system the design should consider the volume, geometry, and the layout of the physical settings that would affect air velocity especially for outdoor settings.<br><br>Whatever the case in using HVAC, the air movement should also be considered for the noise level associated with out. Higher air velocity may cause higher level of noise which is undesired. |

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| G181 | **Provide options for users to adapt to the thermal condition** | It useful to apply the "Adaptive Principle" in school to satisfy user thermal comfort. The concept gives a great importance to the ability of the users to react to thermally discomfort. people with more opportunities to adapt themselves to the environment or the environment to their own requirements will be less likely to suffer discomfort. Some adaptive strategies may include: changing clothes, activities, or more important if they feel they have options such as changing air movement speed, or opening windows. |
| ***Indoor Air Quality Performance*** | **98%** | **Reflection** |
| G182 | **Ensure adequate air ventilation and filtration** | Studies have indicated that poor indoor air quality has a direct effect on students' health and academic performance. In addition to the technical specification that should be ensured in selecting the air conditioning system or the ventilation system, the building should be design to utilize natural ventilation. Orientation of the building, location, size, and proportion of the openings, use of atrium and inner courts are all passive means for natural ventilation. |
| G183 | **Ensure routinely cleaning of air headlining units** | As it is usually the main means for ventilating the indoor environment, air handling units and ducts should be regularly cleaned. |
| G184 | **Select site for minimum outdoor pollutants** | Selection of proper site is the first step toward clean indoor air. Site selection process should set clear criteria ensuring that the school is within minimum polluted environment. Generally, the site should be away from highways and industrial zones as they are polluted by vehicles and plants exhausts. |

# CHAPTER 9

## CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

Reviewing the literature proved that a new type of education has being globally evolving. The evolving educational paradigm is taking tentative steps toward the mainstream. There are variations of terms for it, one of which is "learner-centered learning" with much emphasis put on the collaborative learning environment. The literature also demonstrated that the various restructuring concepts of this paradigm have showed great promise relating to learners academic and social-life performance. If the impact of these concepts lives up to their initial promise, they will place a tremendous pressure on traditional school facilities. Keeping in mind the importance of having a physical environment supporting the demands of the evolving educational paradigm, the thesis –through its various chapters –has concluded the following:

**Chapter 1:**

- The previous studies conducted in school facilities –with particular reference to Saudi Arabia –have ensured that education and school facilities are developed in isolation of each other. As a result, there is no relevance between the educational objectives and the physical settings.

**Chapter 2:**

- The conventional school model that was initiated by an old perception about education that emphasizes repetition and memorization, and greatly influenced by the industrial revolution has become unable to cope with the well established educational concepts and the epistemic and the sentimental goals of the school users.

- The literature about the educational system in Saudi Arabia has shown that although the Saudi educational system has witnessed a great maturity since its early establishment, we are currently in a transition period that will place the platform for the future of the education in the kingdom. This period is rendered with a lot of ambiguity that has resulted in many difficulties which the educational system must to resolve.

- With regards to the school buildings, the literature has shown a number of shortcomings such as:

    - Generally, there was an agreement that school buildings tend to be behind the educational development.

    - School buildings tended to be always short of resources, equipment and furniture.

    - The past as well as the current adapted building models have been rigid and resistive to change, which limit the capability of the facility to grow and accommodate the evolving needs of education

    - More emphasis was given to quantity of school buildings rather than the quality of them, while the two requirements have to be balanced.

- The design of the school facilities gave too much emphasis to the formal education that is directly related to the academic curriculum, and has forgotten the hidden curriculum.

- The developments in the study of the mind and how humans learn and their impact on learning theories and teaching pedagogy, have resulted in new perception about education and learning, which require different practices of education and learning than what was dominant.

- The timeframe within which education is taken place, and the era characteristics for which learners are prepared to face are considered as main influential factors that should be considered when planning for educational system in general and school building in particular.

- Although there is a shortage in the research regarding the new directions of the physical environment of the school facilities, it could be said that there is a strong agreement about the impact of the physical environment on teachers and students' behavior and attitudes, and an expected consensus about the direct effect of the physical environment on academic performance.

- The three components discussed in this chapter (mentioned above) have paved the way for the evolution of a new educational paradigm that is totally different than the convention one. The school building is a main stone in this development and should be rendered by the characteristics of the evolving paradigm.

**Chapter 3:**

- School design should be developed in light of the educational goals and objectives, and should be a tool facilitating achieving them. In real practice, these goals and objectives are experiences by teachers and students through variety of learning activities. Thus, it is important to consider the learning activities demanded to achieve the goals and objectives as the departure point toward designing the school building.

- The learning activity and the activity settings pertaining to facilitate them are more reliable base for design school buildings than academic curriculum which is subjected to change. Consequently, the more successful school building is the one that can accommodate as much as possible learning activities through providing diverse, but integrated learning activity settings. The study proposed fifteen activity settings derived from the learning activities demanded by eighteen identified learning modalities (or teaching/learning strategies).

**Chapter 4:**

- The efficient planning and designing process of school building is the one that benefits from the previous similar example of school projects and tries to implement the lessons learned on the next projects. One of the widely accepted concepts to achieve that is through the assessment of building performance in periodical base. Post-Occupancy Evaluation (POE) has received more attention recently as a soft tool used to conduct building performance assessment. There are many benefits of applying POE in school building. These benefits are categorized as short-term benefits, medium-term benefits and long-term benefits. One of the main strengths of the POE is the involvement of the building users in the assessment process.

- It is very important for any assessment process to be more than a judgment on historical events, it should be a tool used to forward results for future use.

- There is a lack of an accountable tool to measure the performance of public schools in Saudi Arabia based on educational priorities, especially when considering the evolving educational paradigm and the needs of the school users.

- Throughout the use of the developed assessment framework, all the representative school samples have showed incapability to cope with the educational and users needs. The process included the assessment of three different prototypes of schools. Although some prototypes have more potential to adapt to the new demands, they all fall to the category of the conventional school model (the industrial model) which is far away from the optimum model needed to achieve the educational goals and objectives of today and future.

**Chapter 5:**

- A series of guidelines were developed taking in consideration current and future schools, with more emphasis on the later. They can be found in the form of new concepts and emerging issues which need to be taken in consideration, a basic approach toward providing alternative solutions, and sometimes ready-use architectural details. The guidelines were classified based on the fifteen proposed activity settings.

- The developed guidelines take into consideration three main elements of building performance; functional, behavioral and technical. In addition, they aim to make school buildings capable of:
    - Accommodating diverse learning strategies and activities
    - Accommodating current and future changes
    - Supporting integration of activities
    - Meeting users' epistemic and the sentimental expectations

## 6.2 Contributions of New Knowledge

The thesis has contributed to the knowledge in the area of its concern in the following ways.

- The thesis developed a universal approach intended to contribute to the process needed to translate the educational goals and objectives into a responsive physical learning environment.
    - Based on this approach, a conceptual structure for the physical learning environment was proposed. The structure was based on fifteen flexible, integrated, but well defined activity settings that were derived from learning activities and considered users' needs which arise from the engagement in these activities.
    - The structure could be utilized as a base for further research aimed to bridge the gap between the current model of school facilities and the optimum school facility models.

- Based on the proposed structure, the thesis provided a series of guidelines intended to provide a general visualization of the learning environment, and specific physical characteristics of each identified learning activity settings.
    - The guidelines can be implemented for future schools, as well as improving current schools.
    - The guidelines could serve the A/E practice in developing future school physical settings.

- The thesis developed a framework for assessing the performance of the school facilities in terms of educational and users' needs. The structure of the assessment tool was based on the identified activity settings. Thus, the tool could be used for providing a feedback from existing schools, or as a checklist for designing future schools.

- The thesis introduced a participatory approach where the occupants of the school could participate actively in the process of assessing and improving schools physical settings.

## 6.3 Recommendations for further Study

### 6.3.1 Within the Subject of the Study

- Within the context of Saudi Arabia, there is a need to conduct similar studies including a large sample of schools covering all the provinces and geographic locations of the Kingdome.

- The need to involve more participants from different areas: A/E, educators, administrator, parents, community institutions and the business sector.

- Need to develop simple design patters (graphical representations) serve as a common language between all participants.

- Need to conduct periodical POEs for school facilities to develop reliable database about schools performance.

- Need to broaden the scope of the guideline to cover all aspects of school facilities.

### 6.3.2 Educational Concerns

- Need to create a positive school culture, within which educational objectives are clearly identified and practiced by users.

- Need to promote a variety of learning methods and strategies, by training teachers how to implement them, and encourage/help students to utilize them.

- Need to investigate the potential benefits of extra-curriculum activities, and how it could be utilized to support the achieving the educational objectives.

### 6.3.3 General School Facility concerns

- **Need to optimize school facility operation**. For most of the school facilities in Saudi Arabia, there are no operational provisions aimed to optimize the performance of the facility. For example, among the schools used in this study, there are some prototypes that have more potential to adapt to the educational and users requirements. Because of the inefficient

operational strategies, these prototypes do not show any improvement on the overall facility performance.

- **Need for new planning methods**. Conventional planning methods most probably will lead to a conventional school building. Worldwide attention is given today to the participation of all stockholders related to schooling. This should include school administration, teachers, students, parents, community institutions and organizations. Thus, there is a need to provide a framework optimizing the way in which these stakeholders influence the planning process of the school facilities in Saudi Arabia.

- **Need to promote the perception about the physical environment**. Part of the problem hindering the development in the planning, design and management of school facilities is the manner in which school facilities have been perceived by the educational community and public at large in Saudi Arabia. The dominant belief is that a building is passive shell surrounding what is important: teaching and learning. Thus, to have a real change there is a need to change the way the school building is perceived. Teachers –in particular –should be aware of the potential impact of the physical environments on learning process.

- **Need to maintain an optimum technical performance including safety provisions.** Technical and safety provisions of school facilities tend to be constant as they represent the background of the facility. Although they are the most objective component of building performance, the design and the operation practice of schools tend to overlook these aspects that should not be compromised.

- **Need to investigate the impact of implementing a new time schedule in the design and use of school's spaces and facilities**. If we are going to implement the educational concepts of the new paradigm, definitely,

another time schedule for the school will be needed. The segmentation of the school day into a certain number of classes each 45 minutes was tailored for one form of learning. In addition, students within learner-centered learning should not do the same things in the same time. All this will have a great impact in the way school spaces and facilities are used.

- **Need to rethink about schools' furniture industry.** Due to the long period of the adherence to one model of school (the conventional model), a complete school furniture industry has been developed to serve this model. Many researchers believe that both the adapted model and the furniture industry have contributed to the survival of each other. Many aspects of furniture may be including in these process such as suitability, functionality, flexibility, durability, maintainability and comfort

- **Need to investigate the continuous development of technology.** Technology revelation has never stopped. As it could be noticed today, the uses of basic technology tools have already changed a lot of yesterday's practices. Today, distance learning and online programs are common place worldwide. If the technology revolution keeps going in this way, which is expected, schools concerned should not only rethink the school building, but even if there is a need to provide more physical settings.

- **Need to reinvestigate the concept of community school.** Although the concept of community school is not new, the existing model of it needs to be updated in light of the evolving role of school in its community. Unfortunately, the idea of community schools is a missed opportunity in Saudi Arabia, and has not been ever tested seriously before. No valid justifications have been provided in neglecting such a central educational and community concern.

- **Need to develop a comprehensive framework of design educational physical environment**. There are many attributes influencing the process of developing a physical model for educational purposes. While some of them are directly related to education and the learning process, others such as economic considerations have an indirect relation to education. There is a need to develop a framework of designing school buildings considering all the influencing variables. Such a model will requires a multi-disciplinary team(s) working together for optimizing the school building facilities.

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# Appendixes

## Appendix-A: The General Goals and Objectives of the Strategic Plan of Education in Saudi Arabia

(**Source**: Ministry of Education, 2004)

| Goal | Objectives |
|---|---|
| 1. The education of 4-6-year-old children and the consideration of kindergarten as an independent stage in terms of its buildings and syllabi from other education stages. | 1. To accommodate 4-6-year-old children (kindergarten stage) at a rate of 40% by the end of the plan.<br>2. To update the programs and activities on which early childhood education is based.<br>3. To supply kindergarten with specialized cadres to meet such stage classes at a rate of 10%.<br>4. To develop the programs and tools to measure children's preparedness for the pre-school stage.<br>5. To develop a personnel preparation and qualification program at the kindergarten stage. |
| 2. Accommodation of all age categories from 6-18-year-olds at various stages of education. | 1. To make basic education compulsory.<br>2. To improve admission rates to an annual rate of 2% and to achieve accommodation of all male and female students by the end of the plan.<br>3. To secure the government's school buildings to accommodate the expected student population's growth to reach the rate of 90%.<br>4. To increase the number of male and female teachers at an annual rate of 3.5% according to the expected needs estimates. |
| 3. Deepening the spirit of loyalty and proud of the country through intellectual awareness based on recognizing issues of the country. | 1. Enlightening students with the challenges that face their country through scientific and objective view.<br>2. Fixation the concept of temperance (mildness) other's respect, objective argumentation, and rejecting extreme views (ideas).<br>3. Enhancing teacher's role in achieving the concept of national loyalty. |
| 4. To prepare students academically, and culturally at a local and international level to be able to achieve advanced posts internationally in the fields of maths and sciences for the various age categories, taking into account International tests' standards. | 1. To enhance co-operation and exchange in cultural and educational fields between the Ministry and its international counterparts and establish the proper communication and administrative channels for such endeavor.<br>2. To enrich the participation of the Ministry of Education in educational and cultural activities.<br>3. To enhance the benefits of programs and projects by international and local educational organizations.<br>4. To ensure the inclusion of international standard levels for students' academic (scientific) performance and for knowledge acquisition.<br>5. To promote and facilitate students' participation in international Math and science tests. |
| 5. To organize girls' technical education. | 1. To update the regulations and related systems in girls' vocational education and training.<br>2. To increase the girls' education and vocational training by accommodating students at an annual rate of 30% in girls' technical education. |

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| 6. To develop the educational system for students with special needs. | 1. To develop educational programs for gifted male and female students in scientific and creative fields.<br>2. To develop special education systems to correspond with contemporary international expectations and attitudes.<br>3. To develop special education programs for students with disabilities.<br>4. To secure the materials and proper educational environment for students with special needs.<br>5. To increase teachers' vocational development to fully prepare them to work effectively with students with special needs.<br>6. To increase the opportunities for the development of the special categories of education shared with the private sector.<br>7. To expand society's participation in protecting the rights of children with special needs. |
| 7. Development and growth of the Ministry's personnel educational and administrative training | 1. To develop the planning methodology for the educational and administrative training of the Ministry's personnel and its execution in compliance with modern international trends.<br>2. To develop training and assessment in the educational system.<br>3. To train personnel in the educational field at an annual rate of 25%. |
| 8. Improvement of internal and external sufficiency for the educational system. | 13. To reduce the failure rate to 5% in the elementary stage, 7% in the intermediate stage, and to 8% in the secondary stage.<br>14. To develop classroom patterns of learning and teaching (individual learning) to achieve better results according to student levels.<br>15. To reduce the drop-out rates to a general rate of 1% in all stages.<br>16. To diversify the standards of academic acquisition tests and their technologies.<br>17. To secure a safe school environment.<br>18. To improve the rates of success.<br>19. To improve the average number of teachers per student to that of 1 to 20 in the various educational fields by the end of the plan.<br>20. To improve the average number of administration employees per number of educational job occupants to a rate of 1 to 20.<br>21. To allocate financial resources conservatively in order to reduce rates of resource waste.<br>22. To improve the quality of male and female secondary education for university study.<br>23. To provide male and female students with the appropriate and necessary skills to enter the labor market.<br>24. To adopt a system of comprehensive quality in education. |

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| 9. To develop syllabi based on Islamic values leading to the development of male and female students' personality and to their integration in society as well as to the achievement of scientific and thinking skills and life characteristics resulting in self education and lifelong learning. | 12. To develop syllabi that will ensure the development of the Muslim learner's personality to make him proud of his faith and to be loyal to his country in practice and conduct.<br>13. To develop syllabi in accordance to contemporary international trends according to the Islamic values.<br>14. To concentrate on students' acquisition of the skills of thinking, analysis, and communication.<br>15. The syllabi are to include new useful issues and to secure flexibility in dealing with the expected changes in knowledge and technology.<br>16. To provide students with the skills required for various social situations.<br>17. To develop self-education and life-long educational skills.<br>18. To provide students with the necessary skills to deal with advanced information and knowledge.<br>19. To activate the educational process through the employment of computer programs and education technologies and resources.<br>20. To increase the students' share in summer and non-summer activities to achieve practice at a rate of three hours per week.<br>21. To enable students to acquire the skills to invest their leisure time appropriately.<br>22. To provide male and female students with the required skills to practice their roles in forming a Muslim family. |
| 10. To improve the quality of male and female teachers and to increase the citizens' rate in the education sector to achieve the full use of Saudi human resources. | 1. To develop education and teaching methodologies.<br>2. To develop the educational supervision methodologies in accordance with the aimed development of the educational system.<br>3. To increase the acceptance rate at teacher colleges of male and female students specializing in Arabic, Math,<br>4. Science, English and Computer Science at a rate of 20%.<br>5. To adopt a renewal system for male and female teachers to work for five years and to grant career practice licenses.<br>6. To develop and periodically administer integrated standard tests to male and female teachers.<br>7. To modify the work system to allow for the maintenance of distinguished professionals at schools.<br>8. To develop a wages and rewards system that will prevent the loss of distinguished teaching professionals.<br>9. To build and develop specific standards for male and female teachers' performance based on an accountability system.<br>10. To realize a rate of 95% in of Saudinization in all stages of education and jobs. |

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| 11. To develop the educational structure and to update the school map to meet the expected quantitative and qualitative changes in the next stage | 4. To replace the government's school buildings with modernly equipped ones at an annual rate of 10% for rented buildings.<br>5. To develop the school buildings' facilities in view of the vision and schools' future.<br>6. To secure and improve the required sources of education technologies in school buildings.<br>7. To increase sport facilities to allow students to get real practice of sport activities at an average of 8 meters per each student.<br>8. To increase male and female students' share in cultural, social, and scientific activities.<br>9. To link population movements and attitudes to the distribution of schools and buildings.<br>10. To secure efficient financial resources for school construction and renovation. |
| 12. To develop the infrastructure of information and communication technology and its employment in education and learning. | 1. To establish an integrated system for the application of information technology.<br>2. To establish an integrated system for the application of communication technology in education.<br>3. To enhance the integration between machine and human knowledge. |
| 13. To develop male and female adults' education and to eradicate illiteracy | 1. To increase the flexibility of the educational system to allow for easy exit and return to it (flowage).<br>2. To provide parallel educational channels to accommodate the educational system's external students.<br>3. To develop long-distance learning and the application of mechanisms in education to a suitable extent for the Saudi environment.<br>4. To expand the current scopes of male and female adults' education and to adopt flexible systems through advanced contexts suitable for male and female adults' needs and circumstances.<br>5. To support the services of male and female adults' education, the eradication of illiteracy, and the location of the focus of their needs.<br>6. To improve the quality of male and female adults' education in the classrooms. |
| 14. The Ministry's comprehensive administrative development | 1. To improve administrative procedures inside the educational system.<br>2. To build a geometric frame and system to facilitate the achievement of the ten-year plan's related goals.<br>3. To develop and improve the system of appointment selection and promotion in the educational system.<br>4. To raise the rate of professionals with higher qualifications required in the educational system.<br>5. To grant more powers, to reduce centralization (in the Ministry of Education's administrations and schools), and to enhance educational leaderships to be efficient in the development of the educational system.<br>6. To develop and enhance schools' administration to reach a modified form of school self-administration. |

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| 15. Expansion of social participation in education | 1. To polarize the social force qualified to participate in illiteracy programs.<br>2. National education's horizontal expansion with the support of the Ministry's supervisor to reach a participation rate of 25% in the total number of students.<br>3. To increase attorneys' participation in schools' administration.<br>4. The effective participation of attorneys and other social groups in the development of educational processes.<br>5. To adopt a modern technological system to activate the communication process between the school and the rest of the establishments in society.<br>6. The preparation of students and teachers for their participation in international scientific forums and conferences. |
| 16. To establish integrated systems for acc2ountability. | 1. To polarize the social force qualified to participate in illiteracy programs.<br>2. . National education's horizontal expansion with the support of the Ministry's supervisor to reach a participation rate of 25% in the total number of students.<br>3. To increase attorneys' participation in schools' administration.<br>4. The effective participation of attorneys and other social groups in the development of educational processes.<br>5. To adopt a modern technological system to activate the communication process between the school and the rest of the establishments in society.<br>6. The preparation of students and teachers for their participation in international scientific forums and conferences. |

## Appendix-B: Enriched List of Educational Objectives

| | الأهداف المرتبطة بالجانب الإيماني و النفسي للمتعلم | ملاحظات |
|---|---|---|
| 1 | تحقيق دعم الولاء لله وحده و جعل الأعمال خالصة لوجهه و مستقيمة على شرعه. | |
| 2 | تكوين فكر إسلامي منهجي تستقيم به نظرة المتعلم إلى الكون والإنسان و الحياة في الدنيا و الآخرة، وما يتفرع عنهما من تفصيلات. | |
| 3 | تزويد الطالب بالأفكار و المشاعر و القدرات اللازمة لحمل رسالة الإسلام. | |
| 4 | تحقيق الخلق القرآني في المسلم والتأكيد على الضوابط الخلقية لاستعمال المعرفة. | |
| 5 | رعاية الشباب على ضوء المنهج الإسلامي وعلاج مشكلاتهم الفكرية و الانفعالية و مساعدتهم على اجتياز هده المرحلة الحرجة من حياتهم بسلام. | |
| 6 | تكوين الوعي الإيجابي الذي يواجه به الطلاب الأفكار الهدامة و الاتجاهات المضلة. | |
| 7 | تعزيز القيم الروحية و الإنسانية. | |
| | **الأهداف المرتبطة بتنمية الشخصية و التعامل مع الآخرين (تكوين الشخصية و السلوكيات الاجتماعية)** | **ملاحظات** |
| 1 | تنمية القدرة على ضبط النفس، و الالتزام بالمبادئ الأخلاقية. | |
| 2 | تنمية القدرة على التكيف و إعادة التكيف مع المتغيرات المتسارعة، و التعامل مع الضغوط، و حل المشكلات. | |
| 3 | تشجيع الفرد على تحمل المسؤولية عن إعماله. | |
| 4 | تعزيز الثقة لدى الطلاب و التشجيع على الأفكار الإبداعية. | |
| 5 | تأكيد مبدئي التعلم الذاتي، و التعلم مدى الحياة. | |
| 6 | تنمية روح المثابرة للوصول إلى الأهداف. | |
| 7 | تنمية الاستقلالية في التفكير و تحقيق الذات للمتعلم | |
| 8 | التنمية الوجدانية و تنمية الذوق العام للمتعلم | |
| 9 | تنمية المهارات اللازمة للمواقف الاجتماعية المختلفة. | |
| 10 | التحفيز على المبادرة، و حرية التعبير، و إبداء الآراء النقدية ومناقشتها مع الآخرين. | |
| 11 | الحث على فهم الآخرين و احترامهم، و تقدير التنوع و التباين. | |
| 12 | تنمية التفاعل الناقد (الواعي) مع الآخرين بما في ذلك التحدث و الاستماع و القدرة على التصرف كفرد قي فريق. | |
| 13 | ترسيخ مبدأ تقبل الرأي الآخر، و إعطاء الآخرين حق فحص الأفكار. | |

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|---|---|---|
| 14 | تنمية القدرة على العمل التعاوني مع مختلف الأشخاص. | |
| 15 | تنمية مهارات حل النزاع و التفاوض. | |
| | **الأهداف المرتبطة بالجانب المدني و الحضاري للمتعلم (المواطنة و التفاعل الحضاري)** | **ملاحظات** |
| 1 | غرس حب الوطن، و الاعتزاز بالقيم و الموروثات الثقافية الإيجابية. | |
| 2 | تقوية علاقة الطالب ببيئته المحيطة ومجتمعه الذي يعيش فيه. | |
| 3 | التأكيد على أهمية الفرد و دوره الفاعل، و مسؤوليتهمن أجل رفعة وطنه. | |
| 4 | تنمية إحساس الطالب بمشكلات المجتمع الثقافية و الاقتصادية و الاجتماعية وإعداده للإسهام في حلها. | |
| 5 | تدريب الفرد على واجبات المواطنة و المشاركة الاجتماعية و السياسية. | |
| 6 | تزويد المتعلم بالقدر المناسب من المعلومات الثقافية و الخبرات المختلفة التي تجعل منه عضوا عاملا في المجتمع. | |
| 7 | فهم قدر من التنوع الثقافي و تقدير التباين و الاختلاف. | |
| 8 | تثقيف المتعلم ببعض الشؤون و القضايا العالمية. | |
| 9 | الاهتمام بالانجازات العالمية في مختلف الميادين، و إدراك أن التقدم في العلوم هو ثمرة للجهود الإنسانية عامة. | |
| 10 | إدراك دور علماء المسلمين، و الإلمام بآرائهم و بابتكاراتهم العلمية و العملية. | |
| 11 | تمكين المتعلم بلغة أخرى من اللغات الحية للاستفادة و الإفادة. | |
| | **الأهداف المرتبطة بالتربية من أجل العمل و الإنتاج (الإعداد للدراسة بأنواعها المختلفة و التهيئة لسوق العمل)** | **ملاحظات** |
| 1 | معرفة الفروق الفردية للمتعلمين للمساعدة على تقدمهم وفق قدراتهم واستعداداتهم و ميولهم. | |
| 2 | غرس حب العلم و العمل من خلال تكوين المهارات التعليمية و التطبيقية. | |
| 3 | إعداد الطلاب القادرين لمرحلة الدراسة بمستوياتها المختلفة في المعاهد العليا و الكليات بمختلف تخصصاتها. | |
| 4 | احترام قيمة الجهد، وقيم أخلاقيات العمل. | |
| 5 | تهيئة سائر الطلاب للعمل في ميادين الحياة بمستوى لائق. | |
| | **الأهداف المرتبطة بالجانب العقلي للمتعلم ( المحتوى الأكاديمي)** | **ملاحظات** |
| 1 | تنمية التفكير العلمي و روح البحث و التجريب. (التفكير الرياضي والمهارات الحسابية و التدريب على استعمال لغة الأرقام و الإفادة منها في المجالين العلمي و العملي) | |
| 2 | تنمية مهارات القراءة وعادة المطالعة سعيا وراء زيادة المعرفة. | |
| 3 | اكتساب القدرة على التعبير الصحيح في التخاطب و التحدث و الكتابة بلغة سليمة و تفكير منظم. | |
| 4 | التركيز في العملية التعليمية على كيفية التعلم بدلا من سيادة التلقين. | |
| 5 | تنمية التفكير الناقد و الإقناع المنطقي و حل المشكلات. | |
| 6 | تنمية مهارات فن الحصول على المعلومة.(القدرة على التعامل مع الكم الهائل من المعلومات، فرز الزهيد من الثمين، وتحليلها و تصنيفها و توظيفها). (إنتاج المعرفة وليس استهلاكها) | |

| | | |
|---|---|---|
| 7 | تنمية مهارات التفكير: تعريف المشكلات وتحديد الأهداف. | |
| 8 | تنمية مهارات جمع البيانات: الملاحظة وتكوين الأسئلة. | |
| 9 | تنمية مهارات التذكر: عمل الرموز والاستدعاء. | |
| 10 | تنمية مهارات التنظيم: المقارنة، التصنيف، الترتيب، التمثيل. | |
| 11 | تنمية مهارات التحليل: معرفة المكونات، الأفكار العامة، الأخطاء. | |
| 12 | تنمية المهارات الإنتاجية: الاستنتاج، التنبؤ، إضافة التفاصيل. | |
| 13 | تنمية مهارات التكامل: التلخيص و إعادة البناء. | |
| 14 | تنمية مهارات التقويم: إقامة المعايير و التأكد من الحقائق. | |
| 15 | إرساء مهارات التعليم الذاتي تمهيدًا لمبدأ التعليم المستمر | |
| 16 | التحفيز على التفكير المبدع الخارج على المألوف. | |
| | **الأهداف المرتبطة بالتكنولوجيا و تقنية المعلومات** | **ملاحظات** |
| 1 | إزالة الحاجز النفسي الناتج عن استخدام الطلاب و المعلمين لوسائل التقنية في التعليم و الحياة، و تكوين الاتجاهات الإيجابية نحو التعامل معها. | |
| 2 | إدراك الطلاب الدور الذي يمكن أن تأدية التقنية في حياتهم. | |
| 3 | دمج التقنية في الممارسات التعليمية اليومية داخل الفصل. | |
| 4 | تنمية القدرة لدى الطلاب ( و المعلمين) للاتصال بفعالية على المستويين المحلي و العالمي من خلال استخدام التقنية. | |
| 5 | القدرة على جمع المعلومات و استيعابها و عرضها باستخدام التقنية المتوفرة. | |
| 6 | استخدام التقنية و الإنترنت كأداة فاعلة للبحث وجمع المصادر و تكوين المعلومة. | |
| 7 | الارتقاء بالمستوى الإبداعي و الإنتاجي للمتعلم من خلال لاستخدام الأمثل للتقنية. | |
| 8 | إعداد الطلاب ليصبحوا منتجين –إنتاجا نوعيا- و متعلمين مدى الحياة من خلال الاستفادة من تقنية المعلومات. | |
| | **الأهداف المرتبطة بالصحة العامة للفرد** | **ملاحظات** |
| 1 | تعويد الطالب على العادات الصحية السليمة وزيادة الوعي الصحي، وجعلهما جزءا أساسيا من الحياة اليومية. | |
| 2 | التأكيد على أهمية النمو البدني و اللياقي لتحقيق النمو المتكامل للفرد (الجسدي و الذهني و النفسي) | |
| 3 | الارتقاء بالكفاءة الوظيفية لأجهزة الجسم عن طريق رفع اللياقة البدنية للطلاب. | |
| 4 | إكساب الطلاب المهارات الحركية التي تستند إلى القواعد الرياضية و الصحية لبناء الجسم السليم حتى يؤدي الفرد واجبه وفقا للخصائص البدنية لكل فرد. | |

## Appendix-C: Learning Modalities Forms (LMFs)

### Direct Teaching, Lecture Format (Collective Teaching) Learning Modality

| 1 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Direct Teaching, Lecture Format (Collective Teaching)** | Introducing a topic by the teacher, followed by introducing and explaining the information and the required skills. Then, students solve related questions and exercises**.**<br><br>**Approach:** teacher-centric | **Increase students' information about a topic, and gain basic skills about it.**<br><br>☐ To learn essentials concepts, rules and theories<br>☐ To learn basic skills<br>☐ **Other(s):**<br>……<br>…… | ☐ Intensive preparation for the content of a topic by the teacher; including: analyzing, organizing, determining goals, selecting practices and exercises, and enrich the topic<br><br>☐ Communicate and interact the teacher with a large number of students at the same time **(Collective teaching)**.<br><br>▪ **Interact the teacher with students for general practice and activities**<br>○ Ask questions and solve them by students<br>○ Classroom writing activities<br>○ Kinetic Activities (play, typing, etc)<br>○ Interact the teacher with student for individual exercise<br>☐ **Other(s):**<br>……<br>…… | |

## Seminar & Discussion Learning Modality

| 2 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Seminar & discussion** | Interdicting a topic/subject by the teacher, and encouraging students to participate in short discussion.<br><br>**Approach:** teacher-centric | **Teaching basic information about a topic, and present its generalizations in an organized and assorted manner.**<br><br>☐ To Assimilate basic concepts and generalizations<br>☐ To grasp new relations<br>☐ **Other(s):**<br>……<br>…… | ☐ Careful preparation for discussion questions: question to know students' background about the topic, stimulating question, review questions, questions that connect between concepts<br><br>☐ Attention to make a thoughtful summary for the discussion<br><br>☐ Interact the teacher with a large number of students at the same time (Collective teaching), while keeping students attention<br><br>☐ Change in class's circumstance, from static condition to active participation from all the audiences<br><br>☐ Using the derived relations in explaining new events or solve new problems by the students<br><br>☐ **Other(s):**<br>……<br>…… | |

## Team Collaborative Work (2 to 6 Students) Learning Modality

| 3 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Team Collaborative Work (2 to 6)** | Students with diverse capabilities work in small group (2-6). Each group is required to accomplish a task, where each member in the group carries out part of the responsibility.<br><br>**Approach:** learner-centric | **Development of various skills; including academic and social skills.**<br><br>☐ To develop high intellectual skills (problem solving, critical and creative thinking, analyzing and conclusion, taking decision)<br>☐ To develop social skills<br>☐ To develop positive attitude for students toward subjects, teachers, and school<br>☐ To encourage self-development and self-recognition<br>☐ To develop management skills<br>☐ To develop linguistic skills<br>☐ **Other(s):**<br>……<br>…… | ☐ Clear determination of academic and social skills intended to be acquired by students<br>☐ Careful preparation for discussion questions: question to know students' background about the topic, stimulating question, review questions, and questions that connect between the relations<br>☐ Learning students social and cooperative skills (when and how to be used)<br>☐ Bringing into being opportunities for students to practice their communication skills<br>☐ Team work (2 to 6) within learning space<br>☐ Teacher ability to communicate with groups and individual when ever its necessary<br>☐ Availability of learning resources for teachers and students to be used whenever they are needed<br>☐ Easiness and flexibility to reach learning resources<br>☐ Possibility of using the learning resources by more than one group at the same time<br>☐ Conducting individual task (performed by one student)<br>☐ Breaks and time-outs for refreshment<br>☐ Groups interaction and practicing collective activities<br>☐ Group presentation for its ideas and solutions, and discussing them with others<br>☐ Discussing lessons learned and summarizing them by all the participants<br>☐ **Other(s): team**<br>……<br>…… | |

## Problem Solving Learning Modality

| 4 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Problem Solving** | Intellectual perception involves a systematic process conducted by individual\group in order to reach to a solution(s) for a problem.<br><br>**Approach:** learner-centric | **Enhancement of scientific and research methods for the learner**<br><br>▪ To develop high intellectual skills<br>○ Problem solving<br>○ Critical thinking<br>○ Creative thinking<br>○ Analyzing and drawing out conclusion<br>○ Decision taking<br>☐ To utilization information by applying them in real life situations<br>☐ Te develop self-responsibility and persistency toward finding solutions<br>☐ To develop linguistic skills<br>☐ **Other(s):**<br>……<br>…… | ▪ **Teacher role: introduce problems in a way attracting students' attentions**<br>○ Talking about the problem<br>○ Writing on the board, or using projecting devices<br>○ Reading from book, newspaper or magazines<br>○ Presenting multimedia materials about the problem<br>○ Felid trips<br><br>▪ **Student\group roles: conducting problem solving procedure**<br>☐ Determining the problem to be solved in clear form<br>☐ Collecting data, information and facts related to the problem<br>○ Using reference books<br>○ Conducting experiments and taking notes<br>○ Conducting interviews and questionnaires<br>○ Doing research through the internet<br>☐ Processing the collected data (analyzing, documenting, classifying, etc)<br>☐ Suggesting solutions (possible alternative solutions)<br>○ Considering rational thinking<br>○ Seeking of creative thinking | |

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| | | | ☐ Comparing between the solutions and selecting the more suitable solution(s)<br>○ Generating criteria for comparison through individual/group work, or by consultation with teacher<br><br>☐ Experimenting and executing the solution<br>○ Individual/team planning for solution execution<br>○ Conducting experiments<br>○ Conducting interviews and questionnaires<br>○ Implementing the solution in reality<br><br>☐ Evaluating the solution<br>○ Determining the level of validity for the solution<br>○ Providing verification for solution validity<br>○ Identifying difficulty of implementing the solution, and how it could be overcome<br>○ Considering the ability to generalize the solution and implementing it in reality<br><br>☐ **Other(s):**<br>……<br>…… | |

## Constructive Learning Modality

| 5 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Constructive Learning** | Organizing of learning events within the learning environment in a way allows the learner to construct the knowledge himself through introducing basic information about a topic, testing his knowledge about it, enriching it, and helping him to use the obtained knowledge in new situations.<br><br>**Approach:** learner-centric | **Construction of knowledge by students themselves.**<br><br>☐ To develop skills for independent learning<br>○ Self study and research<br>○ Observation<br>○ Comparison<br>○ Analyzing and drawing out conclusion<br>☐ To understand basic information (concept, principle, theory)<br>☐ Te modify incorrect conceptions<br>☐ To develop critical and creative thinking<br>☐ To develop communication skills (ability to dialogue with others)<br>☐ To apply basic information in new events<br>☐ To bringing out relations | **Stages for constructive learning**<br>▪ **Activation stage:** stimulate students about the topic, and test their background about it, and introducing the problem needs to be solved<br>○ Questions evoke students' astonishment<br>○ Conducting scientific activities evoke students' attentions<br>○ Presenting real life examples (happened or expected to happen)<br>○ Conducting primary investigation about phenomenon by students, and requiring them to produce inferences<br>○ Conducting group discussion<br><br>▪ **Exploration stage:** reaching to answers by students throughout following scientific research methods<br>○ Direct perceptible interaction with objects or phenomenon<br>○ Collecting data, information and facts related to the problem<br>○ Conducting scientific experiments<br>○ Exposing to learning resources<br>○ Conducting exploration and investigation activities (classification, judgment, prediction, syllogism, explanation) | |

| | | | | |
|---|---|---|---|---|
| | | between science, technology and real life<br><br>☐ **Other(s):**<br>……<br>…… | ■ **Suggesting alternative solutions**<br>○ Considering rational thinking<br>○ Seeking of creative thinking<br><br>■ **Comparing between the solutions and selecting the more suitable solution(s)**<br>○ Generating criteria for comparison through individual/group work, or by consultation with teacher<br><br>■ **Experimenting and executing the solution**<br>○ Individual/team planning for solution execution<br>○ Conducting experiments<br>○ Conducting interviews and questionnaires<br>○ Implementing the solution in reality<br><br>■ **Evaluating the solution**<br>○ Determining the level of validity for the solution<br>○ Providing verification for solution validity<br>○ Identifying difficulty of implementing the solution, and how it could be overcome<br>○ Considering the ability to generalize the solution and implementing it in realty<br><br>☐ **Other(s):**<br>……<br>…… | |

## Diagnostic/Prescriptive Teaching Learning Modality

| 6 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Diagnostic/ Prescriptive Teaching** | The emphasis on learning mistakes caused by: deficiency in information, inability to express knowledge, confusion in information, misconceptions, or imperfection in performing some skills.<br><br>It is accomplished by integrating between diagnostic and prescriptive<br><br>**Approach:** teacher-centric | **Developing basic academic knowledge and skills**<br><br>☐ To form the fundamentals of an academic material<br>☐ To develop the basic required skills<br>☐ To enable most of the students reaching perfection level in conducting certain skill<br>☐ **Other(s):**<br>……<br>…… | ▪ **Procedure of Diagnostic/Prescriptive Teaching**<br><br>☐ **Students orientation**: inform them about the strategy and how it works, and determining the level of perfection of the students<br><br>☐ **Collective teaching**: teaching students the required information and skills using collective teaching strategies (lecture and discussions)<br><br>☐ **Diagnostic:** determine whose students reached the level of perfection and whose not, and identifying common mistakes and prescriptive methods<br><br>☐ **Prescriptive and enrichment of learning:** correcting the mistakes for those who didn't reach perfection, and enrich knowledge for those who reach perfection<br><br>☐ **Diagnostic repetition:** (repeating diagnostic stage again)<br><br>☐ **Prescriptive repetition:** (repeating prescriptive stage again)<br><br>☐ **Conclusive evaluation**: determining whose reached level of perfection, and taking decision either to move forward, or repeat prescriptive in different ways<br><br>☐ **Other(s):**<br>……<br>…… | |

# Project-Based Learning Modality

| 7 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Project-Based Learning** | Intended work involves certain objectives related to the real life. It may include hands-on or mental works, and it may be done individual or as teamwork<br><br>**Approach:** learner-centric | **Relating theories to the practical life, and connect school environment to community. It also reinforce the concept of personalization of learning**<br><br>☐ To develop work ethics<br>☐ To encourage creation and imagination<br>☐ To develop self-construction of knowledge and self-dependence<br>☐ To achieve integration between various academic subjects<br>☐ To develop team-working skills<br>☐ To encourage open competition between students<br><br>☐ **Other(s):**<br>……<br>…… | ☐ Direct collective teaching to teach basic concepts and skills<br>☐ Integration between individual teaching (one teacher) and team teaching (more than one teacher) to enrich students knowledge<br>☐ Encouraging critical and creative thinking among students<br>☐ Exchanging and discussing of new ideas between students<br>☐ Transferring knowledge and information into sensible product<br>☐ Working in small collaborative team or conducting individual task<br>☐ Availability of learning resources, and the possibility to use them by different groups at the same time<br>☐ Exchange of knowledge between learners through discussing ideas, or presenting completing or under construction projects<br>☐ Encourage local and public participation in the learning activities by exposing them to the sigh of vision<br>☐ Affording of required tools and equipments, and the easiness to store and access them<br>☐ Providing suitable place for keeping completed or under construction projects<br>☐ Allow greater and more flexible time for students to work in their projects<br>☐ Considering breakout periods as they are required by students<br>☐ **Other(s):**<br>……<br>…… | |

## Investigation & exploration Learning Modality

| 8 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Investigation & exploration Learning** | Obtaining knowledge depending on actual practices and real experiments and learning from rights and fouls instead of reliance on textbooks or other direct consumption of information.<br><br>Stimulating students to generate assumptions, and let them work to proof and generalize them, so that they could be used in similar situations.<br><br>**Approach:** learner-centric | **Developing investigation and exploration skills.**<br><br>☐ **To develop scientific and research skills**: conducting experiments, observation, analogy, classification, compression, and conclusion<br>☐ To increase the motivation for learning, and develop individual independency and self-responsibility<br>☐ **Other(s):**<br>……<br>…… | ▪ Stimulate students' minds and challenging their thinking throughout presenting cases that they are incapable to explain using their background knowledge or traditional epistemic methods<br>○ Questions evoke students' astonishment<br>○ Conducting scientific activities evoke students' attentions<br>○ Presenting real life examples (happened or expected to happen)<br>▪ **Generating possible assumptions by students that may provide answers for the raised questions**<br>○ Trying creative thinking<br>○ Manipulating available data to build up information<br>○ Utilizing former knowledge<br>▪ **Giving students the opportunity to test the assumption they proposed**<br>○ Conducting experiments<br>○ Doing research using various learning resources including the internet<br>○ Applying scientific research methods: prediction, derivation, classification, analogy, comparison and explanation<br>☐ **Regenerating of assumption, and working to proof them**<br>☐ **Formulating of generalizations and concepts**<br>☐ **Implementing the formulated concepts to solve similar problems, and using them in real life**<br>☐ **Other(s):**<br>……<br>…… | |

## Inquiry-Based Learning Modality

| 9 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Inquiry-Based Learning**<br><br>**I** | Motivate student to ask questions about a general subject. Based on student's questions, the student going to conduct a research in certain topic related to the subject.<br><br>**Approach:** learner-centric | **Developing intellectual and scientific research skills**<br><br>☐ To promote independent thinking, and self-identification<br>☐ To strengthen the relation between the student and his community and environment<br>☐ To develop learning skills rather than direct teaching<br>☐ To develop scientific research skills<br>☐ To develop persistence spirit toward achieving goals<br><br>☐ **Other(s):**<br>……<br>…… | In addition to the important role of the teacher to keep the discussion within the intended subject, he is required to ask a lot of ***"why(s), how(s), and what is the proof"*** questions.<br><br>☐ **Identifying topics**:<br>○ Generating questions by the student with the help of the teacher and student's classmate<br>○ Determining the type of the required information<br><br>☐ **Methods of information research**:<br>○ Identifying all possible information resources<br>○ Selecting the most suitable resources<br><br>☐ **Allocating the resources and how the information could be accessed**:<br>○ Determining the means and resources<br>○ Collecting the information<br><br>☐ **Utilization of the information**:<br>○ Extracting the related information<br>○ Analyzing, classifying and sorting the information | |

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| | | | ☐ **Formation of knowledge about the topic**:<br>○ Generating more questions and ideas about the topic and trying to answer them<br>○ Organizing and synthesizing all the collected information and make up relations between them<br>○ Presenting the reached results and solutions by using various medias<br><br>☐ **Evaluating the results/solutions**<br>○ Assess the adequacy of the solutions<br>○ Assessing the reliability of the solutions<br>○ Transfer the results/solutions to handle similar circumstances, and applying them in the real life<br><br>☐ **Other(s):**<br>……<br>…… | |

# Computer-Based Learning Modality

| 10 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Computer-Based Learning** | Using computers as a fundamental tool in achieving educational objectives through providing a well-organized and fully-integrated technical support to the learning environment<br><br>**Approach:** learner-centric | **Promoting educational quality, and improving student's academic and practical opportunities in the era of technology**<br><br>☐ To utilize technology and internet as effective tools in education<br>☐ To integrate technology in every day exercises within and outside classrooms<br>☐ To enable learning anytime, and any where<br>☐ To increase interconnection between student, teacher and family<br>☐ To promote creativity and increase productivity<br>☐ To consolidate the concepts of independent-study and continuing-education<br><br>☐ **Other(s):**<br>……<br>…… | ☐ Increase classrooms interaction, and the interaction with the scientific material by using computer<br>☐ **Drill and Practice;** students are taught the basic concepts, and the computers are used to develop skills through series of examples.<br>☐ **Tutorial Programs**; introducing the information to the student in small packages followed by questions. Then, the computer analysis the answers and provide feedback revision<br>☐ **Gaming Programs**: connecting game procedures to educational objectives<br>☐ **Simulation Programs**: within a virtual reality environment, students encounter situation similar to those exposed to in real life without harming himself and with less cost<br>☐ **Problem Solving Programs**; two types:<br>○ **Problem made by the learner**: where learner write down the problem in logical format, and the computer does the processing<br>○ **Prescriptive problem**: where the computer provides help for the learner to solve the problem<br>▪ **Other forms of using technology**<br>☐ Using internet to obtain information and doing research<br>☐ Distance learning<br>☐ Utilizing technology in building operations and expose them to students as learning tools<br>☐ **Other(s):**<br>……<br>…… | |

# Individualized Instruction Learning Modality

| 11 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Individualized Instruction (one-on-one learning with teacher)** | Suitability of the academic content and its quantity and methods of teaching to the capability and interest of the individual learner.<br><br>**Approach:** learner-centric | **Personalization of education based on learner's capabilities and interest**<br><br>☐ To consider individuals' differences of the learners<br>☐ To identify strength and weakness points of individual and work on them<br>☐ To develop independent thinking and self-autonomy<br>☐ To response to the uniqueness needs of the individual<br>☐ To promote perfection level of individual<br>☐ To complement other learning resources to teacher effort<br>☐ **Other(s):**<br>……<br>…… | ☐ Identifying individuals' differences and considering them in learning process<br>☐ Using various assessment methods including standard tests, interview, questionnaires, hands-on exercise and etc.<br>☐ Take care of individual personality and psychology, and benefiting from them in promoting learning<br>☐ Working out more opportunities for individual learners to meet with their teachers<br>☐ Emphasizing communication to assure proper guidance to learner by affording various communication methods<br>☐ Diversity of learning resources<br>☐ Implementing interactive educational technology<br>☐ Diversity of assignments and working activities according to the individual learner<br>○ Written exercises and application<br>○ Oral questions, interlocutions and discussion<br>○ Laboratory experiments<br>○ Supplementing reading assignments<br>○ Hands-on and kinetic activities<br>○ Meditated and creative thinking<br>☐ Ability to manage work, time and place<br>☐ Ability to present results<br>☐ **Other(s):**<br>……<br>…… | |

# Independent Study Learning Modality

| 12 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Independent Study** | Independency of the learner on himself to expand his knowledge in a particular topic according to his capabilities.<br><br>**Approach:** learner-centric | **Personalization of education based on learner's capabilities and interest**<br><br>☐ To consider individuals' differences of the learners<br>☐ To develop independent thinking, work, and self-recognition<br>☐ To consolidate the concepts of independent-study and continuing-education<br>☐ To promote persistence and appreciation of effort<br>☐ To build up individual independency and self-responsibility<br>☐ To develop learner's decision-taking ability and standing for consequences<br>☐ **Other(s):**<br>……<br>…… | ☐ Given the student the freedom to choose topics (within certain subject) according to his capabilities and interest<br>☐ Given the student the freedom to select information acquirement methods, and results obtaining approaches<br>☐ Given the student the freedom to expand his knowledge in certain topic as long as he needs<br>☐ Affording various learning resources (materials, equipments, tools, etc)<br>☐ Unrestricting the student to work in certain place, or during specific time<br>☐ Take care of individual personality and psychology, and benefiting from them in promoting learning<br>☐ **Other(s):**<br>……<br>…… | |

# Peer Tutoring Learning Modality

| 13 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Peer Tutoring** | Exchange knowledge between students at same or different level. It may occur within classroom activities – with the existence of the teacher, or outside the classroom –without the existence of the teacher.<br><br>**Approach:** learners-centric | **Create friendly social learning school environment**<br><br>☐ To create kind atmosphere encourage learning<br><br>☐ To encourage constructing positive relationships between learners and teachers<br><br>☐ To integrate between formal and informal learning approaches in order to achieve academic and educational objectives<br><br>☐ **Other(s):**<br><br>……<br>…… | ☐ Cooperation of students and work them together inside the classroom<br><br>☐ Ability to communicate in small group within the classroom<br><br>☐ Ability to communicate outside the classroom for learning purposes<br><br>☐ Ability to set down in small group outside the classroom<br><br>☐ **Other(s):**<br><br>……<br>…… | |

## Learning by Building- hands on Learning Modality

| 14 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Learning by Building- hands on Learning** | Intellectual practicing that including active students interaction with objects, materials and phenomena on order to obtain knowledge<br><br>**Approach:** learners-centric | **Understanding concepts and scientific essentials through perceivable learning environment**<br>☐ To develop cogitation and thinking skills while dealing with objects<br>☐ To develop cognition, observation, and conclusion skills<br>☐ **Other(s):**<br>……<br>…… | ☐ Practicing various kinetic and handiwork activities (drawing, building, assembling, disassembly, etc)<br>☐ Conducting real projects (intellectual or practical)<br>☐ Dealing with variety of materials, objects, instrument, machine<br>☐ Working on problems for disparate periods of time<br>☐ Ability to work individual or in group<br>☐ Presenting of students' works<br>☐ Ability to access and interact with various environments within and outside the school<br>☐ **Other(s):**<br>……<br>…… | |

## Community Service Learning Modality

| 15 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Community Service learning** | Effective participation of the learner in activities serving his community. It also, including the utilization of the community resources and institutions in building up student's education<br><br>**Approach:** learner-centric | **Preparation of well-citizen**<br>☐ To apply epistemic knowledge in real life<br>☐ To strengthen self-confidence<br>☐ To promote continuing-learning<br>☐ To develop social skills<br>☐ To develop student's professionalism<br>☐ To balance students responsibilities (academic, and community responsibilities)<br>☐ **Other(s):**<br>……<br>…… | ☐ Effective participation of students in community services coordinated by the school<br>☐ Enriching student's knowledge about certain subject through the interaction with his community, or through conducting real work related to the subject<br>☐ Developing student's professionalism skills<br>☐ Provide more opportunities for individual work between the student and his teachers<br>☐ Team teaching to enrich students experience and satisfy their divers needs<br>☐ Effective communication and continuing coordination between student, school, family, community and employers<br>☐ **Other(s):**<br>……<br>…… | |

# Field Trips Learning Modality

| 16 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Field Trips** | Organized learning activities conducted by students outside the classroom under the supervision of the teacher for educational purposes<br><br>**Approach:** learner-centric | **Connect knowledge and learning to the real life, and expand learning sources.**<br>☐ To strengthen the relation between the learner and his environment<br>☐ To achieve integration between schools and community<br>☐ To stimulate thinking through real life problems<br>☐ To use all human senses in learning<br>☐ **Other(s):**<br>……<br>…… | ☐ Preparing students to deal professionally with objects, projects and people<br>☐ Taking notes, formulating relations between ideas, and constructing knowledge by students<br>☐ Preparing reports and presenting them by students<br>☐ Affording transportation means and supporting facilities<br>○ Affording buses, and considering accessibility and safety requirements<br>○ Students charge/discharge areas to/from buses<br>☐ **Other(s):**<br>……<br>…… | |

## Performance and Art-Based Learning Modality

| 17 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Performance and Art Based Learning** | Utilizing arts activities (drama, theater, recitation, painting, art works) in education, sentimental development and creativity of learners<br><br>**Approach:** learner-centric | **Well balance preparation of individual including general tact and creativities**<br>☐ To encourage invention and creative thinking<br>☐ To introduce entertaining and recreation to education<br>☐ To maintain traditional values and heritages<br>☐ To develop individual sentimental and general tact<br>☐ **Other(s):**<br>……<br>…… | ☐ Playing roles by students<br>○ Students play teachers' roles<br>○ Students play the roles of the scientific components of the subject<br>☐ Performing drama (theater)<br>☐ Conducting art works<br>○ Practicing all forms of painting<br>○ Exercising artistic hand works (ceramic, brazen, etc)<br>☐ Performing recitation and folklore arts<br>☐ Reciting poetry and speech<br>☐ **Other(s):**<br>……<br>…… | |

## Performance and Art-Based Learning Modality

| 18 Learning Strategy | Brief Description | Objective(s) | Activities Included | Note |
|---|---|---|---|---|
| **Stimulating Games** | Organized activities played in light of set of rules, where one or more students competing to achieve clear objectives<br><br>**Approach:** learner-centric | **Achieving variety of objectives based on the type of the game**<br><br>☐ To equip students with practical skills<br><br>☐ To motivate students to learn, play real roles and solve problems<br><br>☐ To develop general skills in different fields<br><br>☐ To consider individual differences<br><br>☐ **Other(s):**<br>……<br>…… | ☐ **Preparation stage**: getting familiar with the game, its rules, and the roles of the actors<br><br>☐ **Executing stage**:<br>○ Using or practicing the game<br>○ Given the learner the opportunity to reach to the objective(s), while considering individual differences<br>○ Following up the procedure by the teacher<br>○ Encouraging interaction and competition between actors<br>○ Allowing acceptable level of movement and noise associate with playing the game<br><br>☐ **Evaluation stage**: participation of all students and teacher(s) to determine to which level the objectives were met<br><br>☐ **Following up stage**: improve the maturity of conducting skills by exercising variety of games<br>○ Kinetic games<br>○ Educative games<br>○ Electronic games<br><br>☐ **Other(s):**<br>……<br>…… | |

## Appendix-D: Activity Setting Forms (ASFs)

## Form 1: Teachers Workplaces

| Teachers Workplaces {Professional Working Env.} | Comments |
|---|---|
| **Availability of places for variety of activities**<br><br>**Individual work offices/workstation**<br><br>○ Privacy and ability to modify as desired<br><br>**Collaborative workplaces (2-6) teachers**<br><br>○ Space for brainstorming<br>○ Space for preparation of topic/course components<br>○ Space for dialogue and discussion<br>○ Flexibility in arranging furniture and working surfaces<br><br>**Meeting spaces**<br><br>○ Professional meeting halls/rooms<br>○ Spaces for short meeting/interview (teacher/teacher, teacher/students, teacher/parent)<br><br>**Faculty lounge (Social spaces)**<br><br>○ Comfortable chairs<br>○ Socialization (less formal design)<br>○ Space for refreshment and snacks | |

| Teachers Workplaces {Professional Working Env.} | Comments |
|---|---|
| **Storage spaces**<br><br>○ General storage spaces<br>○ Private storage spaces<br><br>**Workspace accommodations**<br><br>○ Printers<br>○ Scanners<br>○ wallboards<br>○ Plasma screen and projection devices<br><br>**ITC utilization**<br><br>○ Telephones<br>○ Fax<br>○ Desktop top and portable computers<br>○ Local net work Area (LAN)<br>○ Internet<br><br>☐ **Others:**.....<br>..... .....<br>☐ ……<br>…….. | |

# Form 2: Educational Materials

| Educational Materials {Enriched Learning Env.} | Comments |
|---|---|
| **Availability of various learning materials**<br><br>○ References, books, scientific documents<br>○ Newspapers, and periodical journals<br>○ Films, tapes and CDs/DVDs (audio, still and animated pictures)<br>○ TV and radio programs<br>○ Pictures, slides and transparent materials<br>○ 3D pictures, maps, posters and illustrations<br>○ Reduced and natural models<br>○ On line resources through the internet<br><br>**Accessibility of the educational materials (for teachers/students)**<br><br>○ Availability of some of them in the main learning spaces<br>○ Availability of most of them around teachers/students workplaces | |

| Educational Materials {Enriched Learning Env.} | Comments |
|---|---|
| **Storage spaces Storage spaces for educational materials**<br><br>○ Diversity of storing spaces accordance to the stored materials<br>○ Adequacy and capacity of storage space<br><br>**Security of educational materials areas**<br><br>○ Self surveillance by users (locating materials within teachers/students workplaces)<br>○ Locating materials away from public areas<br><br>Using security means and technology<br><br>○ Manual and electronic locks<br>○ surveillance camera<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 3: Presentation Tools

| Presentation Tools {Communicated Learning Env.} | Comments |
|---|---|
| **Divers means for presenting and exchanging knowledge and ideas**<br><br>○ Wallboards<br>○ Interactive whiteboards<br>○ Computers<br>○ Overhead projectors<br>○ Still and animated display devices<br>○ TV receiving and display devise (plasma)<br>○ Audio devices<br><br>**Accessibility and ready use of the devices**<br><br>○ Availability of the devices within the main learning spaces, or close to them<br><br>Capability of presenting/display works by individuals/groups at the same time<br><br>○ Availability of more than one device/tool within the space (based on users volume)<br>○ Distributing devices in different locations within the school (based on activity types) | |

| Presentation Tools {Communicated Learning Env.} | Comments |
|---|---|
| **Availability of technical and logistical supports**<br><br>○ Adequacy and suitability of the surfaces used to project on<br><br>Availability of electrical support<br><br>○ stabile electrical power<br>○ Adequate and sufficient electricity outlets<br>○ Safe electrical installations and extensions<br>○ Availability of technicians and the ability to contact them<br><br>**Environmental quality of the space for display**<br><br>Visual treatment of space<br><br>○ Light control (natural or artificial)<br>○ Overcome glare effect<br><br>Audio treatment of space<br><br>○ Adequacy of audio systems<br><br>Adequacy of sound performance of building material and furniture<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 4: Collective Teaching

| Teacher-Centric Approach {Collective Teaching Env.} | Comments |
|---|---|
| **Centric teacher's position within the learning space**<br><br>○ Interposition and facing of teacher workspace to the students<br>○ Prominence of teacher workspace (specially with many audience and spacious room)<br>○ Organization of projection surfaces within the vertical plane behind the teacher<br>○ Organization of display places within the horizontal plane in front of the teacher<br><br>○ Organization of presentation equipments and educational materials around teacher's workplace | |

| Teacher-Centric Approach {Collective Teaching Env.} | Comments |
|---|---|
| **Effective visual communication between the teacher and the students**<br><br>○ Arranging students sitting in front of teacher's space in orthogonal rows and columns, or in ray arrangement<br>○ Arranging learners' devices and equipments to the sides of their workstations<br>○ Using low-profile equipments and furniture<br><br>Reducing movement and circulation within the active zone<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 5: Collaborative Students Work

| Collaborative Students Work {Cooperating Learning Env.} | Comments |
|---|---|
| **Easiness to arrange and rearrange furniture and working surfaces to form different group sizes as needed**<br><br>○ Using general use tables more than traditional classroom tables<br>○ Arranging tables in cluster forms related from within, and interconnect with other clusters<br>○ Capability to adjust work surface area, and easiness to move furniture<br>○ Adequacy of working surfaces to accommodate various users' activities (writing, carve, design, drawing, using computer)<br><br>☐ **Affording adequate storage spaces to keep groups' works**<br><br>( storing paper, designs, models, tools and equipments) | |

| Collaborative Students Work {Cooperating Learning Env.} | Comments |
|---|---|
| **Provide diverse physical environments for collaborative work, to effectively facilitate different activities and stimulating students**<br><br>○ Spaces for concentration and production<br>○ Spaces for creative thinking and generating of ideas<br>○ Spaces for conducting scientific experiments<br>○ Spaces for practicing handworks<br>○ Spaces for presentation an discussions<br><br>Flexibility to move from one activity to another<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 6: Student Individual Deskwork

| Student individual deskwork {Production Workstations Env.} | Comments |
|---|---|
| **Individual deskwork: tasks that require student to concentrate and produce works** (such as problem determining, data processing, rational thinking, problem solving, critical thinking, etc)<br><br>**Characteristics of the workspace:**<br><br>**Adequacy of desk surface for conducting diverse activities simultaneously**<br><br>○ Holding references, books, papers and other resources<br>○ Reading and taking notes<br>○ Using notebook computer<br><br>☐ Readiness of technical support (ex: electrical extension, outlets and task-light) | |

| Student individual deskwork {Production Workstations Env.} | Comments |
|---|---|
| **Personalization of the individual workstation**<br><br>○ Clear identification of individual Territorial space<br>○ Ability to add personal touches (picture, watch, trophy, etc)<br>○ Adjustable furniture (specially desk and chair)<br>○ Comfortable chair for long use<br>○ Personal safe and secure storage<br>○ Availability of task light<br>○ Using of portable partitions<br><br>☐ Adequacy of sound performance of building materials, finishes and furniture (sound absorption materials)<br><br>☐ **Others:** .....<br>..... .....<br>☐ ……<br>…… | |

# Form 7: Creative Thinking

| Creative Thinking {Stimulating Learning Env.} | Comments |
|---|---|
| **Exterior building form**<br><br>○ Distinctive architectural features of the school building<br><br>**Interior characteristics of the building**<br><br>○ Plenty of natural light<br>○ Diversity of artificial light<br>○ Use of multi colours and textures<br>○ Create spaces that offer visual choices of shape and form<br>○ Disperse of technology all around the building<br><br>**Designing the school as an "open textbook"**<br><br>(Safely exposing some of the building operational systems)<br><br>○ Lighting and electricity<br>○ Air-conditioning and mechanical systems<br>○ ICT accommodations<br>○ Lighting an acoustical treatment materials | |

| Creative Thinking {Stimulating Learning Env.} | Comments |
|---|---|
| **Introducing new learning environments that are pleasant to students**<br><br>○ "learning Coffee" (adapted from coffee shop, and used to stimulate discussions)<br>○ "learning Street" (adapted from public court, and used to stimulate social and cultural activities)<br>○ "Imagination Exhibition" (adapted from public exhibition, and used to exhibit student inventions)<br><br>**Providing areas (corners) stimulating creative thinking within the main learning spaces or around the supporting spaces**<br><br>○ Less formal environment<br>○ Comfortable seating<br>○ Sufficiency of natural night, and diversity of artificial light<br>○ Use of colors and various finishes<br>○ Outdoor view toward open horizon (wide vista)<br>○ Indoor windows toward active spaces<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 8: Scientific Experiments

| Scientific Experiments {Advanced Professional Env.} | Comments |
|---|---|
| **Collective teaching and demonstration**<br>○ Easy and ready access to educational materials and presentation devices<br>○ Ability to see demonstrations clearly by all students<br>○ Students ability to take note during teacher demonstration/explanation<br>**Laboratory activities of individuals and small groups**<br>Ready access and use to services and equipments<br>○ Laboratory tools and equipments<br>○ Power and heat sources<br>○ Faucet and washbasin<br>○ Arranging groups setting fairly apart to facilitate teacher transition around them | |

| Scientific Experiments {Advanced Professional Env.} | Comments |
|---|---|
| **Non-laboratory activities of individuals and groups** (collecting information, planning for experiment, writing reports, discussing works)<br>○ Table adequacy for writing and holding books<br>○ Table suitability for teamwork to discuss and review works<br>○ Ready access to learning resources, including computers<br>○ adequate circulation paths for easy movement for teachers and students<br>**Safety considerations**<br>○ Safety exists to outdoor area, or to a safe indoor area<br>○ Availability of fire distinguishers and safety systems<br>○ Use of fire resistive building materials and furniture<br>☐ **Others:** .....<br>..... .....<br>☐ ……<br>…… | |

# Form 9: Hand-on Works Activities

| Scientific Experiments {Advanced Professional Env.} | Comments |
|---|---|
| **Providing workshops for different purposes including crafts, arts and sciences**<br><br>○ Large area with high ceiling<br>○ Capability to divide the space into smaller units according to the nature and period of projects<br>○ Availability of power and supporting services (suspended from ceiling, projected from the side walls, or running under floor)<br>○ Availability of specialized tools and devices (ex: carpentry, welding)<br><br>Ability to move work surface and assemble it with other units to form larger work surface | |

| Scientific Experiments {Advanced Professional Env.} | Comments |
|---|---|
| **Providing workshops for heavy projects (ex: building and painting)**<br><br>○ Spacious area<br>○ Heavy-duty work surfaces<br>○ Stand-working table<br>○ Easiness to cleaning and maintain<br>○ Spaces for storing tools and devices<br>○ Affording of primary supplies (water, electricity, row materials)<br>○ Ability to expand work space into outdoor area through wide doors<br><br>☐ **Availability of sufficient spaces to display students works**<br><br>**Spaces to store completed student-works, and work under construction**<br><br>☐ **Others:** .....<br>..... .....<br>☐ ……<br>…… | |

## Form 10: Discussion and Ideas Exchange

| Exchange Ideas {Interactive Forum Env.} | Comments |
|---|---|
| ☐ Spacious environment with minimum obstacles<br><br>**Arrangement of seats in away allow direct communication of students/teachers, students/students**<br><br>○ Less formal sitting arrangement<br>○ Adjacency of students setting<br>○ Sitting all/most of the students within equal distance from the teacher<br>○ Arrange seats, equipments, activities around one plane to increase concentration and interaction<br>○ Ready use of presentation tools to encouraged students presenting ideas | |

| Exchange Ideas {Interactive Forum Env.} | Comments |
|---|---|
| **Diversity of presentation tools**<br><br>○ Wallboard<br>○ Interactive white board<br>○ Computers<br>○ Overhead projectors, and other devices<br>○ TV plasma screen<br><br>☐ **Availability of sufficient and divers places to present students works**<br><br>☐ **Acoustical and visual treatment of the physical environment**<br>☐ **Others:** .....<br><br>..... **.....**<br>☐ ……<br>…… | |

# Form 11: Collecting Data and Information

| Collecting data and information {Multi-recourses Learning Env.} | Comments |
|---|---|
| ☐ Availability of various learning resources: written, audio, visual, an electronic (review educational materials)<br>☐ **Allocate specialized spaces for library and learning resources (**Centric position in the school building)<br><br>Ability to accommodate verity of sitting and activities<br>○ Shelves for references, books and periodicals<br>○ Cabinets for storing learning materials (cassette, CDS/DVDS, slides)<br>○ Area for delivering short lecture<br>○ Area for relaxing and braking-time<br>○ Small rooms (cells) for individual and small group works<br>○ Social zone<br><br>Computer and technology area<br>○ Quick use (standing stations)<br>○ Moderate use<br>○ Portable use (laptops and wireless network) | |

| Collecting data and information {Multi-recourses Learning Env.} | Comments |
|---|---|
| **Availability of wide-collection of presentation and display devices** (review presentation tools)<br>○ Providing electrical support for current and future needs<br>○ Acoustical treatment of the space<br>○ Considering lighting system (natural, artificial), and aesthetics components (innovative design, colors, finishes, furniture) based on activities<br><br>**Affording some of the learning resources within the main learning space (classroom)**<br>○ Availability of shelves for books and main references<br>○ Connecting classroom computer to the local network and learning resources<br>○ Utilizing wireless network<br>○ Using high-speed internet connection<br>○ Providing various computing devices: desktop, laptop and pocket PC<br>○ Possibility of simultaneous use of learning resources and equipments by individuals and groups<br><br>☐ Ready use of learning resources when ever needed by the learner<br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 12: Use of Technology and Computers

| Use of Technology {High-tech Learning Env.} | Comments |
|---|---|
| ☐ **Improving the efficiency of building operation and functionality**<br><br>**Utilizing modern technology in operating the building, and exposing building systems to learners (building as open textbook, or 3D textbook )**<br><br>○ Building acoustical and lighting systems<br>○ HVAC and energy conservation systems<br>○ Communication system<br>○ Safety and security systems<br><br>**Improving the functional performance of the building through utilizing all/most of its spaces as places for learning**<br><br>○ Use of wired or wireless local area network (LAN)<br>○ Connecting school net work system to the learning resources within the school and out of it (through high speed internet connection)<br>○ Improving communication between school, teacher, students, parents and community by using technology<br>○ Using e-mail and electronic work system (e-business) that are connected to the internet | |

| Use of Technology {High-tech Learning Env.} | Comments |
|---|---|
| **Improving classroom interaction, and the interaction with the scientific subject through using technology within the man learning spaces**<br><br>○ Provide wired or wireless net work system within the main learning spaces connected to the internet<br><br>Providing diverse types of computing devices<br><br>Δ Desktop computers<br>Δ Laptop computers<br>Δ Pocket PC and personal digital assistant (PDA)<br>Δ Possibility of storing students' works digitally<br>Δ Ready use of computers, LAN and the internet when they are needed by teachers and students<br><br>○ **Using of electronic learning resources (see collecting data and information)**<br>○ **Providing variety of presentation tools (see presentation tools)**<br><br>**Availability of advanced technology labs** for specialize works (ex: CAD)<br><br>○ Powerful desktop computers<br>○ Advanced presentation and display devices<br>○ Distance-learning lab<br><br>**Ensuring stable power source and other electrical requirements**<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

**Circulation: corridors and intersections**

- ○ Spacious enough for movement and communication
- ○ Ample daylight, and sufficient artificial light
- ○ Availability of sitting area
- ○ Availability of nooks, crannies and niches

Increase the functional value of intersection points by practicing various activities within them

- ○ Display students works
- ○ Display scientific show and programs
- ○ Providing food-trolley vender
- ○ Communication materials between school and students
- ○ Quick-use computer standing stations connect to the school network

**Cafeteria**

Given importance to scheduling break-out and eating time so that less students are serviced with higher quality

- ○ Providing various sitting patterns
- ○ Providing seats and tables for eating
- ○ Providing natural light and views toward outside
- ○ Using of movable furniture

☐ **Others:** .....
..... .....

☐ ……
……

# Form 13: Relaxing and Refreshing Time

| Relaxing and Refreshing Time {Refreshing Env.} | Comments |
|---|---|
| **Within over all school facility**<br><br>○ Quite areas within corridors, circulation nodes, inner courts and cafeteria<br>○ Shaded outdoor sitting areas<br><br>Exclusive recreational areas<br><br>Δ Spacious halls for socialization and entertainments<br>Δ Large shaded terrace extended to outside | |

| Relaxing and Refreshing Time {Refreshing Env.} | Comments |
|---|---|
| **Within main and supporting learning spaces**<br><br>Interior crannies/nooks with distinct design features<br><br>Δ Faced comfortable seats<br>Δ Designed for small number of users<br>Δ Natural daylight<br>Δ Use of quiescent colors<br>Δ Decorated with art works<br>Δ Having view toward exterior open horizon<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 14: Community Relationship

| Community Relationship {Community-Connected Env.} | Comments |
|---|---|
| ☐ Strengthen the relation between school and community through requiring students to conduct some of the learning activities in the community<br><br>**Strengthen the relation between school and community by utilizing facilities and technical accommodations already available in community or in school**<br><br>School facilities serving the community<br><br>Δ Library and learning resources<br>Δ Multi-purposes hall<br>Δ Advanced technical accommodations<br>Δ Sport facilities<br>Δ Outdoor fields and green areas<br><br>**Strengthen the relation between the school facility and its urban environment in which it is located**<br><br>*** Exterior features**<br><br>Designing urban school environment open to the community and welcoming visitors<br><br>Δ Easy access to school<br>Δ Proper selection of school site<br>Δ Availability of parking for users and visitors, and ensuring traffic safety around the school<br>Δ Suitability of school architecture to the urban and demographic environment of the surrounding<br>Δ Aesthetic quality of the school building as it is considered as a vital element in the community<br>Δ Prominence of main entrances of the school, and the attractive design of them | |

| Community Relationship {Community-Connected Env.} | Comments |
|---|---|
| Δ Avoidance of high-solid fence that block visual and moral communication with the community<br>Δ Aware design of outdoor areas<br>Δ Incorporating some of the community architectural characteristics in the design of the school building<br><br>**Interior features**<br><br>Δ Clear identification of public and private use of spaces<br>Δ Availability of reception desk to direct visitors how to use the building<br>Δ Providing spaces designed to receive visitors (specially parents) and facilitating their active participation in the educational activities<br>Δ Thought-out design of circulation to allow easy use for new visitors<br>Δ Providing spaces to display students' work and exposing them to the visitors<br>Δ Providing spaces designed to accommodate social activities where parents and different community groups are expected to participate in addition to teachers and students<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 15: Flexible Learning Setting

| Diversity of Activities {Flexible and Adaptable Env.} | Comments |
|---|---|
| **Design spaces to accommodate general requirements**<br><br>○ Develop design based on similar elements between functions instead of dissimilar elements<br><br>**Arranging spaces around activities that are expected to continue in the future** (activities that are not connected to certain academic curriculum)<br><br>Δ Collaborative team work<br>Δ Independent study<br>Δ Practical and hand-on learning<br>Δ Students presentations<br>Δ Technology (computer) –based learning<br><br>**Possibility to accommodate future changes**<br><br>○ Students enrollment<br>○ Curriculum and courses reform<br>○ Development of learning strategies and teaching approaches<br>○ Rapid and continuous development of technology<br>○ School relation to community and the interaction with its changes<br><br>**Ability to accommodate divers activities**<br><br>○ Collective activities<br>○ Individual activities<br>○ Curriculum and non-curriculum activities<br>○ Practical, hand-on and kinetic activities<br>○ Social activities | |

| Diversity of Activities {Flexible and Adaptable Env.} | Comments |
|---|---|
| **Ability to modify space capacity and configuration and the way it is arranged especially for large halls**<br><br>○ Building spacious spaces with minimum obstructions and minimum interior structural partitions<br>○ Use of movable interior wall<br>○ Use of movable partition with dual functions (partitions, shelves, working surface, storage space)<br>○ Use of flexible movable furniture<br><br>**Utilization of indoor and outdoor courts and fields**<br><br>○ Clear locating of entering in/out points of courts in order to create more usable spaces<br>○ Shading outdoor fields and using natural ventilation to modify weather affect<br><br>**Ability of building systems to accommodate changes**<br><br>○ Electrical and lighting systems<br>○ HVACH system<br>○ Technical and communication accommodations<br><br>☐ **Availability of general purposes storing spaces**<br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 16: Orderly-Configured Learning Setting

| Orderly-Configured Spaces {Harmonious Learning Env.} | Comments |
|---|---|
| **Clear arrangement of facility spaces in terms of users types**<br><br>○ Private use (students/teachers/staff)<br>○ Public use (community)<br>○ Shared use<br>○ Dividing of school spaces, and the formation of space relations<br><br>**Dividing school facility into smaller learning academies**<br><br>Δ Based on function<br>Δ Based on academic subjects<br>Δ Based on academic level<br><br>○ Grouping classrooms within the academies in small cluster forms, located nearby and integrated in function<br>○ Locating supporting spaces close to the main learning spaces<br>○ Strategically locating common and general facilities so that they serve all departments equally<br>○ Closeness of teachers' workplace to students activities spaces (ensuring visual communication)<br><br>Centric position of school administration | |

| Orderly-Configured Spaces {Harmonious Learning Env.} | Comments |
|---|---|
| **Extend activities into circulation for integrative spaces**<br><br>○ Display students' works<br>○ Encouraging spontaneous learning and social communication<br>○ Display scientific materials and TV program<br>○ Providing spaces for individual and small group work<br>○ Providing nooks and crannies for sitting alone<br><br>☐ **Integration between indoor and outdoor environments**<br><br>☐ **Others:** .....<br>..... **.....**<br>☐ ……<br>…… | |

# Form 17: Effective Circulation

| Effective Circulation {Dynamic Learning Env.} | Comments |
|---|---|
| **Within main learning spaces**<br>**Dividing the main learning space according to intended activities**<br>○ Active zone, including project area<br>○ Display, presentation and discussion zone<br>○ Production zone, for individual and teamwork<br>○ Quite zone , for breakout and creative thinking<br><br>**Circulation within learning Space**<br>☐ Reducing moving paths within each function, and identifying them clearly between different functions<br>☐ Arranging teamwork stations in cluster form, related from within and interconnect with other clusters<br>☐ Locating activities involving the use of large equipments to the side of the space and close to the walls<br>☐ L**ocat**ing teacher(s) workplace close to team workplaces<br><br>*** within overall school facility**<br>**Functional integration between adjacent and close spaces** (see harmonious learning environment)<br>○ Enhancing learning experience through circulation<br>○ Accommodating some of the learning activities<br>○ Foster social interaction | |

| Effective Circulation {Dynamic Learning Env.} | Comments |
|---|---|
| **Entrances and Corridors**<br>☐ Spaciousness of school entrances (specially the main entrance)<br>☐ Spaciousness of entrance foyer<br>☐ Spaciousness of circulation paths (specially main circulation) and the scarcity of minor intersections<br>☐ Shortening of long corridor by introducing main circulation nodes<br>☐ Safety Considerations<br><br>**Easiness to understand and remember circulation paths**<br>○ Use of different colours and finishes to distinct paths<br>○ Use of comprehensive signage system throughout the whole building<br>☐ **Vertical circulation elements**<br>○ Sufficiency and adequacy of staircases<br>○ Satisfying safety requirements<br>**Staircase strategic location**<br>Δ Closeness to main entrances or main activities<br>Δ Effective vertical connection between related functions<br>Δ Located to attract the attention to certain places<br>Δ Increase nature daylight within the building through stairwells<br>☐ **Others:** .....<br>..... .....<br>☐ ……<br>…… | |

# Form 18: Building Environmental Systems

| Building Environmental Systems {High Performance Learning Env.} | Comments |
|---|---|
| ☐ **Ability to control environmental parameters and adapt them to users' needs**<br>**Lighting**<br>○ Providing sufficient natural light<br>○ Ability to select between natural and artificial light, or use both<br>○ Availability of different light fixtures to suite different activities<br>○ Control over light level<br>○ Control over glare effect<br>**Acoustic**<br>Reducing of noise level generated from:<br>Exterior Sources<br>◊ Suitability of the site location<br>◊ Building orientation (specially for windows) away from noise sources<br>◊ Use of good sound performance building materials<br>◊ Proper use of plantation to reduce noise<br>Noise sources from within the school and outside the learning spaces<br>◊ Sound quality of interior building materials<br>◊ Proper distribution of spaces according to the type of activities<br>Noise sources from within the learning spaces<br>◊ Sound quality of interior finishes<br>◊ Type of furniture and its finishes<br>◊ Adequacy of sound equipments<br>◊ Spatial arrangement of activities according to its nature | |

| Building Environmental Systems {High Performance Learning Env.} | Comments |
|---|---|
| **Energy conservation and thermal comfort**<br>Energy conservation<br>Δ Suitability of the site, and fully considered orientation of the building on the site<br>Δ Extending the building on the East-West axis, and allocating secondary and less-use spaces toward undesired weather direction<br>Δ Optimum use of window system (location, direction, area), and using of horizontal and vertical shading devices when it is necessary<br>Δ Use of good thermal performance building materials, and use of proper thermal insulations, and ensuring proper construction methods<br>Thermal performance<br>Δ Ability to maintain suitable temperature all around the year (22c to 26c)<br>Δ Ability to control temperature and other parameters accordance to activity types<br>Indoor air quality<br>Δ Ability to open windows for natural ventilation<br>Δ Ability to provide fresh air through using HVAC system<br>☐ **Others:** .....<br>..... .....<br>☐ ……<br>…… | |

# Appendix-E: User's Satisfaction Survey Form

**Questionnaire for assessing the adequacy of school building to facilitate learning activities and satisfy users' needs**

| | | | | |
|---|---|---|---|---|
| **School Name :** | | | | |
| □ **Teacher** | Number of years in teaching: | □ **Student** | Academic Level: | |
| | Duration of using the building: | | Duration of using the building: | |

**Procedures to complete the questionnaire**

- Reading carefully each point in the survey
- Determining the level of importance for each point in facilitating learning activities and satisfying users' needs, where:

**0: Not Important** **1: To somewhat, important** **2: Important** **3: Very important**

- Determining your level of satisfaction regarding your building for each point, where:

**A: Vary satisfy** **B: Satisfy** **C: Not satisfy** **D: Strongly, not satisfy**

| | Assessment Elements | Importance | Evaluation | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | **Teachers Workplaces (filed only by teachers)** | | | | | |
| 1 | Teachers individual workplace | | | | | |
| 2 | Teachers collaborative and teamwork places | | | | | |
| 3 | Teachers and administration meeting spaces/halls | | | | | |
| 4 | Small meeting spaces (teacher/teacher, teacher/student, teacher/parent) | | | | | |
| 5 | Teachers' lounge (for social and break-out time) | | | | | |
| 6 | Office and technical accommodations | | | | | |
| 7 | Teacher individual storage space | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Educational Materials** | | | | | |
| 8 | Availability and diversity of educational materials | | | | | |
| 9 | Ready access and use of educational materials whenever needed by teachers/students | | | | | |
| 10 | Educational materials storage spaces | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Presentation Tools** | | | | | |
| 11 | Availability of various means for explanation and presenting information, and exchanging ideas | | | | | |
| 12 | Ready access and use for the presentation tools whenever needed by teachers/students | | | | | |
| 13 | Availability of electrical and technical supports | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Collective Teaching (lecture)** | | | | | |
| 14 | Teacher's position and his active work area with relate to learners' positions within the main learning spaces (classroom, laboratory) | | | | | |
| 15 | Location of presentation and explanation tools for teacher use | | | | | |
| 16 | Location of presentation and explanation tools to the audience (sight angle) | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Students Collaborative Work** | | | | | |
| 17 | Easiness to arrange furniture and work surfaces to form divers group sizes | | | | | |
| 18 | Availability of various working environments with different features to accommodate several activities' needs | | | | | |
| 19 | Easy movement and transition between activities within learning space, and within the school | | | | | |
| 20 | Storage spaces for team's work | | | | | |
| | Other: | | | | | |

| | | Imp | A | B | C | D |
|---|---|---|---|---|---|---|
| | **Student individual Deskwork** | | | | | |
| 21 | Adequacy of working surface to accommodate various and simultaneous works | | | | | |
| 22 | Sufficiency of workplace area to accommodate functional and personal needs | | | | | |
| 23 | Ability to adapt the workplace to satisfy the needs and desire of the user (adding personal touches, personal storage, adjustable furniture, task light) | | | | | |
| | Other: | | | | | |

| | | Imp | A | B | C | D |
|---|---|---|---|---|---|---|
| | **Creative Thinking** | | | | | |
| 24 | The level to which the overall building design an its physical features stimulate creative thinking and the generation of ideas | | | | | |
| | Other: | | | | | |

| | | Imp | A | B | C | D |
|---|---|---|---|---|---|---|
| | **Scientific Experiments** | | | | | |
| 25 | The ability to see experiments and demonstrations clearly by all students | | | | | |
| 26 | Ready access and use to materials and devices needed to conduct experiments | | | | | |
| 27 | Adequacy of working surfaces to accommodate various activities (collecting information, planning for experiment, writing reports, discussing works) | | | | | |
| 28 | Adequacy of safety requirements | | | | | |
| | Other: | | | | | |

| | | Imp | A | B | C | D |
|---|---|---|---|---|---|---|
| | **Hands-Work Activities** | | | | | |
| 29 | Availability of general use labs/workshops (arts, crafts, science) | | | | | |
| 30 | Availability of workshops for heavy projects (building, painting, repairing) | | | | | |
| 31 | Availability of sufficient spaces to display students works | | | | | |
| | Other: | | | | | |

| | | Imp | A | B | C | D |
|---|---|---|---|---|---|---|
| | **Discussion and Ideas Exchange** | | | | | |
| 32 | Availability of spaces encouraging the communication of teachers/students and students/students | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 33 | Ready access and use of presentation and explanation tools | | | | | |
| 34 | Availability of sufficient and divers places to present students works | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Collecting Data and Information** | | | | | |
| 35 | Availability of various resources to obtain data and information (written, audio, visual, an electronic) | | | | | |
| 36 | Closeness of learning resources spaces from students' workplaces | | | | | |
| 37 | Availability of learning resource within classroom (books, computers, electronic network) | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Developing and Practicing Social Sills** | | | | | |
| 38 | Availability of spaces encourage informal communication between students, teachers and parents | | | | | |
| 39 | Availability of social corners within the main learning spaces stimulating spontaneous interaction between teachers and students | | | | | |
| 40 | Utilization of in-programmed spaces (corridors, inner and outer courts, cafeteria) to encourage social learning and interaction | | | | | |
| 41 | The level to which students feel belong to the school | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Use of Technology and Computer** | | | | | |
| 42 | The level of using technology to increase the efficiency of operating the building | | | | | |
| 43 | Availability of technical accommodations that support every day learning activities | | | | | |
| 44 | Availability of electronic networks (wired, wireless) within classrooms and the whole building | | | | | |
| 45 | Availability and quality of internet connection | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Relaxing and Refreshing Time** | | | | | |
| 46 | Availability of indoor and outdoor areas designed for break0-times | | | | | |
| 47 | Availability of corners/nooks within main learning spaces support refreshing | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Interaction with Community** | | | | | |
| 48 | Level of which teachers and students benefit from community facilities | | | | | |
| 49 | Level of which the community benefit from school facilities | | | | | |
| 50 | Availability of spaces designed to accommodate social activities where parents and different community groups are expected to participate in addition to teachers and students | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Flexibility and Adaptability of Spaces** | | | | | |
| 51 | Building ability to accommodate variety of activities and learning modalities | | | | | |
| 52 | Ability to modify spatial capacity of the space, its configuration and the way it is arranged | | | | | |
| 53 | Level to which inner and outer courts are utilized in doing educational activities | | | | | |
| 54 | Ability to accommodate future changes (users, curriculum and learning strategies, technology, and the relation with the community) | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Space Configuration and Relation** | | | | | |
| 55 | The way the building is divided into smaller units | | | | | |
| 56 | Closeness of supporting spaces to the main learning spaces, and the level of integration between them | | | | | |
| 57 | Location of common facilities and school administration | | | | | |
| 58 | Closeness of teacher area to students work areas | | | | | |
| 59 | Integration between indoor and outdoor environment | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Circulation** | | | | | |
| 60 | Cars parking, and is closeness to entrances for users and visitors | | | | | |
| 61 | Closeness of dropping area to the entrance | | | | | |
| 62 | Sufficiency and adequacy of outdoor walk ways | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 63 | Capacity and adequacy of entrances and inner corridors | | | | | |
| 64 | Easiness to understand and remember circulation paths (specially for new visitors) | | | | | |
| 65 | Staircases locations and adequacy | | | | | |
| 66 | Circulation within main learning spaces (classroom, labs, learning resources, other) | | | | | |
| 67 | The way in which the main learning spaces are divided to accommodate variety of activities (active zone, individual and team work areas, presentation and discussion area, quite area) | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Building Environmental Systems** | | | | | |
| 68 | Natural lighting and ability to have control over it | | | | | |
| 69 | Artificial lighting and ability to have control over it | | | | | |
| 70 | Ability to overcome exterior noise | | | | | |
| 71 | Ability to overcome noise from within the building | | | | | |
| 72 | Ability to overcome noise from within the classroom | | | | | |
| 73 | Ability to provide appropriate room temperature all around the year | | | | | |
| 74 | Quality of indoor air particularly within classrooms | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Safety Considerations** | | | | | |
| 75 | Smoke and fire deduction systems | | | | | |
| 76 | Smoke control system | | | | | |
| 77 | building emergency evacuation requirements (corridors, staircases, exists, emergency lights) | | | | | |
| 78 | Natural visual surveillance of school entrances, activity areas, and spaces equipped with expensive devices | | | | | |
| 79 | Electronic surveillance (ex: surveillance camera) | | | | | |
| 80 | Pedestrians and vehicle safety requirements around the school | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Furniture** | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 81 | Suitability pf furniture to users' needs and comfort | | | | | |
| 82 | Mobility of furniture, and its practicality of reconfiguration to suite variety of activities | | | | | |
| 83 | Quality of furniture materials and its adequacy for cleaning | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **Aesthetics Quality** | | | | | |
| 84 | Building facade and overall exterior design | | | | | |
| 85 | Interior appearance and the overall interior design | | | | | |
| | Other: | | | | | |
| | | **Imp** | **A** | **B** | **C** | **D** |
| | **General Health Considerations** | | | | | |
| 86 | Quality of drinking water and water-cooler | | | | | |
| 87 | Adequacy of sanitary facilities (W.C, sinks, ablution space) | | | | | |
| 88 | Building overall cleanness, and garbage dispose means | | | | | |
| 89 | Smells within the building | | | | | |
| | Other: | | | | | |
| 90 | **What is the level of importance of the physical environment of the school building and its accouterments on the educational process and satisfying users' needs? And what is your overall rating for your school building in these regard?** | | | | | |

- Write down three things you like in your school building, and provide justifications.

| | |
|---|---|
| **1** | |
| **Justification** | |
| **2** | |
| **Justification** | |
| **3** | |
| **Justification** | |

- Write down three things you don't like in your school building, and provide justifications.

| | |
|---|---|
| **1** | |
| **Justification** | |
| **2** | |
| **Justification** | |
| **3** | |
| **Justification** | |

**Thank you for your cooperation**

## Appendix-F: Expert Inspection Form

### **Teacher Workplace Activity Setting –** Expert Inspection Form

| A 1 | **Teachers Workplaces {Professional Working Env.}** | **Capability to cope with Intended Demands** | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | |
| | **Availability of places for variety of activities** | | | | | | | |
| | Individual work offices (Privacy and ability to modify as desired) | | | | | | | |
| | Common workplaces (2-6) teachers (preparation, brainstorming, discussions) | | | | | | | |
| | Personal storage space | | | | | | | |
| | **Office and technology accommodations** | | | | | | | |
| | **Meeting spaces** | | | | | | | |
| | Spacious Professional meeting halls/rooms (equipped technically) | | | | | | | |
| | Spaces for short meeting/interview (teacher/teacher, teacher/students, teacher/parent) | | | | | | | |
| | **Faculty lounge** | | | | | | | |
| | Socialization | | | | | | | |
| | Time-out, refreshment and snacks | | | | | | | |
| | **Over All Evaluation** | | | | | | | |

Expert Inspection Form

| A 4 | Collective Teaching { } | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Centric teacher's position within the learning space** | | | | | | | | |
| | Teacher position with relate to students | | | | | | | | |
| | Organization of projection surfaces | | | | | | | | |
| | Arrangement of presentation tools | | | | | | | | |
| | **Accessibility and ready-use of the educational materials for the teacher** | | | | | | | | |
| | **Effectiveness of the visual communication between the teacher and the students** | | | | | | | | |
| | Arranging students sitting | | | | | | | | |
| | Movement and circulation within the active zone | | | | | | | | |
| | The profile of the used furniture and equipments | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 6 | Student individual deskwork {Production Workstations} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Adequacy of desk surface for conducting diverse activities simultaneously** | | | | | | | | |
| | **Use of technology and the available technical support** | | | | | | | | |
| | **Personalization of the individual workstation** | | | | | | | | |
| | Identification of individual territorial space | | | | | | | | |
| | Ability to add personal touches | | | | | | | | |
| | Adjustable furniture | | | | | | | | |
| | Personal safe and secure storage | | | | | | | | |
| | Availability of task light | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 5 | Collaborative Students Work { } | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Easiness to arrange and rearrange furniture and working surfaces to form different group sizes as needed** | | | | | | | | |
| | Type of used furniture particularly the working tables | | | | | | | | |
| | Arrangement of furniture and working tables | | | | | | | | |
| | Adjustability of working surfaces for configuration in different forms | | | | | | | | |
| | **Availability of diverse physical environments for collaborative work** | | | | | | | | |
| | **Flexibility to move from one activity to another** | | | | | | | | |
| | **Storage spaces for groups' works** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 10 | Discussion and Ideas Exchange {Interactive Forum Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Spaciousness of the space with minimum obstacles** | | | | | | | | |
| | **Arrangement of seats to allow direct communication of students/teachers, students/students** | | | | | | | | |
| | Arrangement of sitting (Informal environment) | | | | | | | | |
| | Centralizing the arrangement around specific direction for more concentration | | | | | | | | |
| | Sitting all/most of the students within equal distance from the teacher | | | | | | | | |
| | **Availability of sufficient and divers places to present students works** | | | | | | | | |
| | **Acoustical and visual treatment of the physical environment** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

| A 3 | Presentation Tools {Communicated Learning Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Availability of divers means for presenting and exchanging knowledge and ideas** | | | | | | | | |
| | Traditional wallboards | | | | | | | | |
| | Technical presentation tools (interactive whiteboard, projector, balsam screen) | | | | | | | | |
| | **Accessibility and ready-use of the educational materials when ever needed by teachers/students** | | | | | | | | |
| | Availability of some of them in the main learning spaces | | | | | | | | |
| | Availability of most of them around teachers/students workplaces | | | | | | | | |
| | **Environmental quality of the space for display** | | | | | | | | |
| | Visual treatment of space | | | | | | | | |
| | Audio treatment of space | | | | | | | | |
| | **Safety and security of storage spaces** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 11 | Collecting data and information {Multi-recourses Learning Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| **Availability of specialized spaces for library and learning resources** | | | | | | | | | |
| | Centric position in the school building | | | | | | | | |
| | **Ability to accommodate verity of sitting and activities** | | | | | | | | |
| | **Accommodation for holding books, and reading spaces** | | | | | | | | |
| | **Technical accommodation, and the use of computers** | | | | | | | | |
| | **Short lectures** | | | | | | | | |
| | **Cells for individual or small group works** | | | | | | | | |
| | **Socialization zone** | | | | | | | | |
| **Visual and acoustical treatment of the spaces** | | | | | | | | | |
| **Affording of some of the learning resources within the main learning space** | | | | | | | | | |
| **Sub-Total** | | | | | | | | | |

| A 2 | Educational Materials {Enriched Learning Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| **Availability of various learning materials** | | | | | | | | | |
| | Readable materials (references, books, journals, etc) | | | | | | | | |
| | Visual and audible materials | | | | | | | | |
| | Models and tangible materials | | | | | | | | |
| **Accessibility and ready-use of the educational materials when ever needed by teachers/students** | | | | | | | | | |
| | Availability of some of them in the main learning spaces | | | | | | | | |
| | Availability of most of them around teachers/students workplaces | | | | | | | | |
| **Places for storing the educational materials** | | | | | | | | | |
| | Adequacy and capacity of storage space | | | | | | | | |
| | Safety and security of storage spaces | | | | | | | | |
| **Sub-Total** | | | | | | | | | |
| **Over All Evaluation** | | | | | | | | | |

| A 8 | Scientific Experiments {Advanced Professional Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Collective teaching and demonstration** | | | | | | | | |
| | Ability to see demonstrations clearly by all students | | | | | | | | |
| | Students ability to take note during teacher demonstration/explanation | | | | | | | | |
| | **Laboratory activities of individuals and small groups** | | | | | | | | |
| | Sitting Arrangement of individual and groups | | | | | | | | |
| | Ready access and use to services and equipments | | | | | | | | |
| | **Non-laboratory activities of individuals and groups** | | | | | | | | |
| | Adequacy of working desk to perform different activities (collecting information, writing typing, discussion) | | | | | | | | |
| | Ready access to learning resources, including computers | | | | | | | | |
| | **safety considerations** | | | | | | | | |
| | Safety exits | | | | | | | | |
| | Fire suppression systems | | | | | | | | |
| | Use of fire resistive building materials and furniture | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

| A 9 | Hand Works Activities {Craftsmanship Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Providing workshops for different purposes including crafts, arts and sciences** | | | | | | | | |
| | Area of the spaces and the flexibility to divide the space | | | | | | | | |
| | Sources of power and supporting facilities | | | | | | | | |
| | Storage spaces | | | | | | | | |
| | **Providing workshops for heavy projects** | | | | | | | | |
| | Area of the space and the capability to expand | | | | | | | | |
| | Accessibility for users and devices | | | | | | | | |
| | Adequacy of working surfaces | | | | | | | | |
| | **Availability of primary supplies (water, electricity, row materials)** | | | | | | | | |
| | **Availability of sufficient and divers spaces to display students works** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 7 | **Creative Thinking** **{Stimulating Learning Env.}** | **Capability to cope with Intended Demands** | | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | **E-IC** | |
| | **Exterior building form** | | | | | | | | |
| | Distinctive architectural features of the school building | | | | | | | | |
| | **Interior characteristics of the building** | | | | | | | | |
| | Adequacy of natural light | | | | | | | | |
| | Outdoor view toward open horizon (wide vista) | | | | | | | | |
| | Indoor windows toward active spaces | | | | | | | | |
| | Use of multi colours and finishes | | | | | | | | |
| | Exposing of building systems (building as 3D textbook) | | | | | | | | |
| | **Availability of corners for stimulating creative thinking within the main learning spaces or around the supporting spaces** | | | | | | | | |
| | **Introducing new learning environments that are pleasant to students** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 13 | **Technology-based setting Computers** **{High-tech Learning Env.}** | **Capability to cope with Intended Demands** | | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | **E-IC** | |
| | **Using technology to improve building operation (including building as open textbook)** | | | | | | | | |
| | **Using of technology to improve the functionality of the building through utilizing all/most of its spaces as places for learning** | | | | | | | | |
| | Use of technology win the main learning spaces | | | | | | | | |
| | Use of technology over the whole building | | | | | | | | |
| | Use of LAN | | | | | | | | |
| | use of wireless network | | | | | | | | |
| | Use of internet | | | | | | | | |
| | **Availability of advanced technology labs** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

| A 12 | **Developing and Practicing Social Skills** **{Social Learning Env.}** | **Capability to cope with Intended Demands** | | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | **E-IC** | |
| | **Providing social corners within main learning spaces** | | | | | | | | |
| | **Providing social corners around the main spaces and supporting spaces** | | | | | | | | |
| | **Utilizing non-programmed paces for social learning** | | | | | | | | |
| | **Circulation:** corridors and intersections | | | | | | | | |
| | Interior courtyards | | | | | | | | |
| | Exterior courtyards | | | | | | | | |
| | Cafeteria and causal eating spaces | | | | | | | | |
| | **Relaxing and Refreshing Time** | | | | | | | | |
| | Quite areas within inner spaces | | | | | | | | |
| | Places within outer areas | | | | | | | | |
| | Availability of exclusive recreational spaces | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 15 | **Diversity of Activities** {Flexible and Adaptable Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Design spaces to accommodate general requirements (based on similarities rather than differences)** | | | | | | | | |
| | **Arranging spaces around activities that are expected to continue in the future (collaborative, independent, technology, etc)** | | | | | | | | |
| | **Ability to accommodate divers activities (collective, individual, curriculum and non-curriculum actives)** | | | | | | | | |
| | **Possibility to accommodate future changes (users, curriculum, technology, relation with community)** | | | | | | | | |
| | **Ability to modify space capacity and configuration and the way it is arranged** | | | | | | | | |
| | **Utilization of indoor and outdoor courts and fields** | | | | | | | | |
| | **Availability of general purposes storing spaces** | | | | | | | | |
| | **Ability of building systems to accommodate changes** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 14 | Relation with Community {Community-Connected Env.} | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Interchangeable utilization of facilities and accommodations between the school and the community** | | | | | | | | |
| | **The relation between the school facility and its urban environment in which it is located** | | | | | | | | |
| | **Exterior features** | | | | | | | | |
| | Ability to Accessibility to the school facilities (location, parking, pathways, surrounding fence)accommodate verity of sitting and activities | | | | | | | | |
| | Suitability of school architecture to the urban and demographic environment of the surrounding | | | | | | | | |
| | **Interior features** | | | | | | | | |
| | Organization of spaces according to the type of use | | | | | | | | |
| | Cells for individual or group works | | | | | | | | |
| | Socialization zone | | | | | | | | |
| | **Visual and acoustical treatment of the spaces** | | | | | | | | |
| | **Affording of some of the learning resources within the main learning space** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 16 | **Space Configuration and Relation** **{Harmonious Learning Env.}** | **Capability to cope with Intended Demands** | | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | **E-IC** | |
| | **Clarity of arrangement of facility spaces in terms of the type of use (private/public/mixed)** | | | | | | | | |
| | **Dividing school facility into smaller learning academies** | | | | | | | | |
| | The concept of dividing spaces (function, academic subject, academic level) | | | | | | | | |
| | Closeness of supporting spaces to the main learning spaces, and the functional integration between them | | | | | | | | |
| | The location of the common use facilities | | | | | | | | |
| | Closeness of teachers' workplace to students activities spaces (ensuring visual communication) | | | | | | | | |
| | Utilization of circulation paths connecting learning spaces to enrich movement experience | | | | | | | | |
| | Integration between indoor and outdoor environments | | | | | | | | |
| | **Availability of advanced technology labs** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| A 17 | **Effective Circulation** **{Dynamic Env.}** | **Capability to cope with Intended Demands** | | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | **E-IC** | |
| | **Within main learning spaces** | | | | | | | | |
| | Dividing the main learning space according to intended activities (active zone, individual or team workplaces, presentation, discussion, break-time, thinking spaces) | | | | | | | | |
| | Arrangement of workstations within individual activity | | | | | | | | |
| | Closeness of teacher workplace to students' workplace | | | | | | | | |
| | **within overall school facility** | | | | | | | | |
| | Functional integration of adjacent spaces | | | | | | | | |
| | Spaciousness of school entrances and pathways | | | | | | | | |
| | Utilization main intersection points in the corridors | | | | | | | | |
| | Easiness to understand and remember circulation paths | | | | | | | | |
| | **Vertical circulation elements** | | | | | | | | |
| | Sufficiency and adequacy of staircases | | | | | | | | |
| | Staircase strategic location | | | | | | | | |
| | Safety considerations | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

| A 18 | **Building Environmental Systems** **{High Performance Env.}** | **Capability to cope with Intended Demands** | | | | | | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|
| | | **E-IC** | **IC** | **S-IC** | **S-C** | **C** | **E-C** | **E-IC** | |
| | **Lighting performance** | | | | | | | | |
| | Adequacy of penetrating natural light and the level of controlling it | | | | | | | | |
| | Adequacy of artificial light and the level of controlling it | | | | | | | | |
| | Ability to overcome glare affect | | | | | | | | |
| | **Acoustical performance** | | | | | | | | |
| | Ability to control outdoor noise sources | | | | | | | | |
| | Ability to control noise from within the school | | | | | | | | |
| | Ability to control noise from within main learning spaces | | | | | | | | |
| | **Energy conservation** | | | | | | | | |
| | Building orientation on the site (extended axis) | | | | | | | | |
| | Location of function with regard to site characteristics | | | | | | | | |
| | Use of glazed surfaces in the exterior envelop | | | | | | | | |
| | Use of thermal performance building materials | | | | | | | | |
| | **Thermal performance** | | | | | | | | |
| | Ability to maintain suitable temperature all around the year | | | | | | | | |
| | Ability to control temperature and other parameters accordance to activity types | | | | | | | | |
| | **Indoor air quality** | | | | | | | | |
| | Natural ventilation | | | | | | | | |
| | Mechanical ventilation | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| B 1 | Safety Requirements | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Fire deduction and suppression** | | | | | | | | |
| | Smoke deduction systems | | | | | | | | |
| | Fire extinguishing systems | | | | | | | | |
| | Distance between extinguishers | | | | | | | | |
| | **Smoke control** | | | | | | | | |
| | Finishing materials and furniture | | | | | | | | |
| | Smoke control system and techniques | | | | | | | | |
| | Compartmentation | | | | | | | | |
| | **Evacuation requirements** | | | | | | | | |
| | Large hall exit door (quality & quantity) | | | | | | | | |
| | Travel distance | | | | | | | | |
| | Horizontal circulation protection | | | | | | | | |
| | Vertical circulation protection | | | | | | | | |
| | Staircase quantity and width | | | | | | | | |
| | Non-slippery floor surfaces | | | | | | | | |
| | Emergency sign and light | | | | | | | | |
| | Emergency communication system | | | | | | | | |
| | Dead-end avoidance | | | | | | | | |
| | Escape exit door quality | | | | | | | | |
| | Discharge areas | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| B 2 | Security | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Storages** | | | | | | | | |
| | Student personal storage security | | | | | | | | |
| | Teacher personal storage security | | | | | | | | |
| | Administration storage security | | | | | | | | |
| | General storage security | | | | | | | | |
| | **Design quality for natural supervision (inside the building)** | | | | | | | | |
| | Location of Administration area and faculty lounge | | | | | | | | |
| | Location of spaces equipped with expensive equipments | | | | | | | | |
| | Separation between general and personal uses | | | | | | | | |
| | Separation between public and private uses | | | | | | | | |
| | Usage of transparent partitions within the building (inner windows) | | | | | | | | |
| | **Design quality for natural supervision (indoor/outdoor connection)** | | | | | | | | |
| | Adequacy of site location | | | | | | | | |
| | Adequacy of building location and orientation on the site | | | | | | | | |
| | Adequacy of building entrance (design & location) | | | | | | | | |
| | Adequacy of school fence with relation to community (visibility) | | | | | | | | |
| | Adequacy of outdoor landscaping | | | | | | | | |
| | **Adequacy of security systems** | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

| B 3 | Circulation: Vehicles and Pedestrians | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Vehicle circulation** | | | | | | | | |
| | Consider busy period & traffic jams | | | | | | | | |
| | Consider pedestrian movement and intersections | | | | | | | | |
| | Enforce slow motion | | | | | | | | |
| | Equipped with traffic signage system | | | | | | | | |
| | Separation of bus, car and services circulations and parking | | | | | | | | |
| | Safe drop area | | | | | | | | |
| | **Site and outdoor paths** | | | | | | | | |
| | Connection to the surrounding neighborhood and buildings | | | | | | | | |
| | Safe pedestrian crosses over streets | | | | | | | | |
| | Direct connection between parking and entrances | | | | | | | | |
| | Main transition zone between outdoor and indoor | | | | | | | | |
| | Prominence of the main entrance | | | | | | | | |
| | Sufficiency of walkways within outdoor | | | | | | | | |
| | Shaded walkways | | | | | | | | |
| | Shaded setting spaces along walkways | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| B 4 | Furniture | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Human factors and comfort** | | | | | | | | |
| | Suitability to human scale and dimensions | | | | | | | | |
| | Comfortableness for long use | | | | | | | | |
| | Adjustability to various human needs | | | | | | | | |
| | Suitability to human scale and dimensions | | | | | | | | |
| | **Flexibility of use** | | | | | | | | |
| | Easy to move | | | | | | | | |
| | Possibility to arrange with different configurations | | | | | | | | |
| | Suitability to use for different functions | | | | | | | | |
| | **Maintainability** | | | | | | | | |
| | Durability of materials | | | | | | | | |
| | Resistance to vandalism | | | | | | | | |
| | Easy to clean | | | | | | | | |
| | Easy to fix | | | | | | | | |
| | **Aesthetics quality** | | | | | | | | |
| | Finish quality | | | | | | | | |
| | Design and color quality | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

Expert Inspection Form

| B 5 | Visual Perception and Aesthetic Quality | Capability to cope with Intended Demands | | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | E-IC | IC | S-IC | S-C | C | E-C | E-IC | |
| | **Visual appearance of the exterior** | | | | | | | | |
| | Harmony of the school building with the surrounding | | | | | | | | |
| | Harmony of the various parts composing the school facility | | | | | | | | |
| | Use of special architectural vocabulary and features | | | | | | | | |
| | Conscious selection of various building materials, finishes and colors | | | | | | | | |
| | Unique design for penetration pointes (entrances) | | | | | | | | |
| | Building massing | | | | | | | | |
| | Subdivision of the building into smaller masses | | | | | | | | |
| | Variation of masses' heights | | | | | | | | |
| | Relation between exterior form and interior function | | | | | | | | |
| | **Outdoor landscaping** | | | | | | | | |
| | **Visual perception and appearance of the interior** | | | | | | | | |
| | Use of variety of color and finishes | | | | | | | | |
| | Use of variety of ceiling heights and floor levels | | | | | | | | |
| | Use of daylight | | | | | | | | |
| | Use of artificial lighting fixtures | | | | | | | | |
| | Aesthetic quality of furniture | | | | | | | | |
| | Use of indoor aesthetic elements and art works | | | | | | | | |
| | Indoor landscaping and plantation | | | | | | | | |
| | **Over All Evaluation** | | | | | | | | |

## Appendix-G: Summary of all Assessment Results

| Teachers Workplace Activity Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| Teachers individual workplace | X | 1.30 | 1.05 | **1.17** |
| Teachers collaborative and teamwork places | X | 1.12 | 0.6 | **0.86** |
| Teachers and administration meeting spaces/halls | X | 1.24 | 0.75 | **1.00** |
| Small meeting spaces (teacher/teacher, teacher/student, teacher/parent) | X | 0.88 | 0 | **0.44** |
| Teachers' lounge (for social and break-out time) | X | 1.10 | 1.05 | **1.07** |
| Office and technical accommodations | X | 0.63 | 0 | **0.31** |
| Teacher individual storage space | X | 0.79 | 0.6 | **0.70** |

| Collective Teaching (lecture) Activity Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| Teacher's position and his active work area with relate to learners' positions within the main learning spaces (classroom, laboratory) | 1.72 | 1.40 | 2.4 | 1.84 |
| Location and accessibility of presentation and explanation tools for teacher use | 1.28 | 1.08 | 0.6 | 0.99 |
| Location of presentation and explanation tools to the audience (sight angle) | 1.46 | 1.23 | | 1.35 |

| Individual Work Activity Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| Adequacy of working surface to accommodate various and simultaneous works | 1.19 | 0.98 | 0 | 0.72 |
| Sufficiency of workplace area to accommodate functional and personal needs | 1.15 | 0.93 | 0 | 0.69 |
| Ability to adapt the workplace to satisfy the needs and desire of the user (adding personal touches, personal storage, adjustable furniture, task light) | 1.15 | 0.98 | 0.12 | 0.75 |

| Collaborative Work Activity Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| Easiness to arrange furniture and work surfaces to form divers group sizes | 1.23 | 1.05 | 0.6 | 0.96 |
| Availability of various working environments with different features to accommodate several activities' needs | 1.12 | 0.87 | 0.3 | 0.76 |
| Easy movement and transition between activities within learning space, and within the school | 1.19 | 0.52 | 0.6 | 0.77 |
| Storage spaces for team's work | 1.18 | 1.07 | 0 | 0.75 |

| Collecting Data and Information Activity Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| Availability of various resources to obtain data and information (written, audio, visual, an electronic) | 1.26 | 0.91 | 0.8 | 0.99 |
| Ready access and use of educational materials whenever needed by teachers/students | 1.11 | 1.12 | 0.80 | 1.01 |
| Closeness of learning resources spaces from students' workplaces | 1.67 | 1.30 | 1.03 | 1.33 |

| | | | | |
|---|---|---|---|---|
| Availability of learning resource within classroom (books, computers, electronic network) | 1.21 | 0.71 | 0 | 0.64 |
| Educational materials storage spaces | 1.33 | 1.04 | 1.28 | 1.21 |
| Visual and acoustical treatment of the spaces | | | 0.6 | 0.60 |

| **Creative and Conceiving Activity Setting** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| The level to which the overall building design an its physical features stimulate creative thinking and the generation of ideas | 1.04 | 1.15 | | 1.10 |
| The overall interior design | 1.15 | 1.36 | 0.45 | 0.99 |
| The overall exterior design | 1.08 | 0.93 | **0.45** | 0.82 |
| Availability of corners for stimulating conceiving thinking within the main learning spaces or around the supporting spaces | | | 0 | 0.00 |
| Introducing new style of physical setting that are pleasant to students | | | 0 | 0.00 |

| **Hands-Work Activity Setting(s)** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| **Scientific Experiments** | | | | |
| The ability to see experiments and demonstrations clearly by all students | 1.40 | 0.95 | 1.5 | 1.28 |
| Ready access and use to materials and devices needed to conduct experiments | 1.11 | 1.15 | 0.75 | 1.00 |
| Adequacy of working surfaces to accommodate various activities (collecting information, planning for experiment, writing reports, discussing works) | 1.21 | 1.17 | 0 | 0.80 |
| Adequacy of safety requirements | 1.30 | 1.14 | 0.5 | 0.98 |

| **Other Activities** | | | | |
|---|---|---|---|---|
| Availability of general use labs/workshops (arts, crafts, science) | 0.78 | 0.42 | 0 | 0.40 |
| Availability of workshops for heavy projects (building, painting, repairing) | 0.57 | 0.56 | 0 | 0.37 |
| Availability of sufficient spaces to display students works | 0.97 | 0.74 | 0.6 | 0.77 |

| **Discussion, Negotiation and Presentation Activity Setting** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| Availability of spaces encouraging discussion of teachers/students and students/students | 1.21 | 0.75 | 0.75 | 0.90 |
| Availability of sufficient and divers places to present students works | 1.13 | 0.91 | 0.6 | 0.88 |
| Availability of various means for explanation and presenting information, and exchanging ideas | 1.70 | 1.21 | 1.8 | 1.57 |
| Ready access and use for the presentation tools whenever needed by teachers/students | 1.30 | 1.11 | 0.3 | 0.90 |
| Availability of electrical and technical supports | 1.46 | 1.34 | | 1.40 |
| Environmental quality of the space for discussion and display | | | 1.2 | 1.20 |

| **Social Activity Setting(s)** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| Availability of spaces encourage informal communication between students, teachers and parents | 1.35 | 0.56 | 1.05 | **0.99** |
| Availability of social corners within the main learning spaces stimulating spontaneous interaction between teachers and students | 1.13 | 0.77 | 0 | **0.64** |

| | | | | |
|---|---|---|---|---|
| Utilization of in-programmed spaces (corridors, inner and outer courts, cafeteria) to encourage social learning and interaction | 1.12 | 0.72 | 0.08 | **0.64** |
| The level to which students feel belong to the school | 0.86 | 0.57 | | **0.72** |
| **Relaxing and Refreshing** | | | | |
| Availability of indoor and outdoor areas designed for breakout-times | 0.76 | 0.78 | 0.45 | **0.66** |
| Availability of corners/nooks within main learning spaces support refreshing | 0.38 | 0.84 | 0 | **0.41** |
| Availability of exclusive recreational spaces | | | 0 | **0.00** |

| **Technology-Based Activity Setting** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| The level of using technology to increase the efficiency of operating the building | 1.20 | 0.54 | 0 | **0.58** |
| Availability of technical accommodations that support every day learning activities | 1.01 | 0.67 | 0.3 | **0.66** |
| Availability of electronic networks (wired, wireless) within classrooms and the whole building | 0.60 | 0.52 | 0 | **0.37** |
| Availability and quality of internet connection | 0.54 | 0.46 | 0 | **0.33** |
| Availability of advanced technology labs | | | 1.8 | **1.80** |

| **Flexible Learning Setting** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| Building ability to accommodate variety of activities and learning modalities | 0.73 | 0.68 | 0.6 | **0.67** |
| Ability to modify spatial capacity of the space, its configuration and the way it is arranged | 1.45 | 0.89 | 0.6 | **0.98** |

| | | | | |
|---|---|---|---|---|
| Level to which inner and outer courts are utilized in doing educational activities | 1.42 | 0.85 | 0.6 | **0.96** |
| Ability to accommodate future changes (users, curriculum and learning strategies, technology, and the relation with the community) | 0.93 | 0.55 | 0.9 | **0.79** |
| Availability of large hall(s) for multi-purpose uses | | | 1.05 | **1.05** |

| **Community Related Activity Setting** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| Level of which teachers and students benefit from community facilities | 1.21 | 0.64 | 0 | **0.62** |
| Level of which the community benefit from school facilities | 1.13 | 0.82 | 0 | **0.65** |
| Availability of spaces designed to accommodate social activities where parents and different community groups are expected to participate in addition to teachers and students | 1.29 | 0.69 | 0 | **0.66** |
| The relation between the school facility and its urban environment in which it is located | | | 0.81 | **0.81** |

| **Orderly-Configured Learning Setting** | **Obtained Score** | | | |
|---|---|---|---|---|
| | **STU** | **TEA** | **EXP** | **AVR** |
| The way the building is divided into smaller units | 1.16 | 0.77 | 0.9 | **0.94** |
| Closeness of supporting spaces to the main learning spaces, and the level of integration between them | 1.32 | 0.88 | 0.6 | **0.93** |
| Location of common facilities and school administration | 1.21 | 0.87 | 0.68 | **0.92** |
| Closeness of teacher area to students work areas | 1.32 | 0.81 | 0 | **0.71** |
| Integration between indoor and outdoor environment | 1.13 | 0.71 | 0.3 | **0.71** |
| **Clarity of arrangement of facility spaces in terms of the type of use (private/public/mixed)** | | | 0.6 | **0.60** |

| Dynamic Learning Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| **within overall school facility *** | | | | |
| Capacity and adequacy of entrances and inner corridors | 1.57 | 1.13 | 1.5 | **1.40** |
| Easiness to understand and remember circulation paths (specially for new visitors) | 1.72 | 1.11 | 1.65 | **1.49** |
| Staircases locations and adequacy * | 1.29 | 1.18 | 0.85 | **1.10** |
| **Within main learning spaces *** | | | | |
| The way in which the main learning spaces are divided to accommodate variety of activities (active zone, individual and team work areas, presentation and discussion area, quite area) | 0.98 | 0.75 | 0 | **0.58** |
| Circulation within main learning spaces (classroom, labs, learning resources, other) | 1.11 | 0.91 | 0.6 | **0.87** |
| **Outdoor Circulation: Vehicles and Pedestrians** | | | | |
| **Vehicle circulation *** | 1.59 | 1.11 | 1.25 | **1.32** |
| **Site and outdoor paths *** | 1.71 | 1.16 | 0.81 | **1.23** |

| High-Operational Performance Learning Setting | Obtained Score | | | |
|---|---|---|---|---|
| | STU | TEA | EXP | AVR |
| Natural lighting and ability to have control over it | 1.69 | 1.46 | 0.6 | **1.25** |
| Artificial lighting and ability to have control over it | 1.80 | 1.21 | 1.8 | **1.60** |
| Ability to overcome exterior noise | 0.96 | 0.96 | 1.8 | **1.24** |

| | | | | |
|---|---|---|---|---|
| Ability to overcome noise from within the building | 1.25 | 1.25 | 0.6 | **1.04** |
| Ability to overcome noise from within the classroom | 1.31 | 1.08 | 0 | **0.80** |
| Ability to provide appropriate room temperature all around the year * | 1.43 | 1.06 | 1.13 | **1.21** |
| Quality of indoor air particularly within classrooms * | 1.49 | 1.30 | 0.6 | **1.13** |

***: The element was assessed based on several criteria**

## Appendix-H: Participants' level of Agreement with regard to the Proposed Physical Characteristics

| Activity Setting | Al-Khaleej | | Al-Kesaea | | Al-Jeser | | P. Mohammad | | Level of Agreement AVERAGE |
|---|---|---|---|---|---|---|---|---|---|
| **Teachers Workplace** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Teachers Individual workplace (office/workstation) | 100% | | 100% | | 50% | | 100% | | 88% |
| Common collaborative workplaces | 78% | | 100% | | 100% | | 100% | | 94% |
| Meeting places | 100% | | 100% | | 100% | | 100% | | 100% |
| Social Spaces | 78% | | 100% | | 67% | | 100% | | 86% |
| Storage space | 100% | | 100% | | 51% | | 100% | | 88% |
| Workplace accommodations | 100% | | 100% | | 63% | | 100% | | 91% |
| ICT utilization | 73% | | 100% | | 51% | | 100% | | 81% |

| Activity Setting | Al-Khaleej | | Al-Kesaea | | Al-Jeser | | P. Mohammad | | Level of Agreement AVERAGE |
|---|---|---|---|---|---|---|---|---|---|
| **Educational Materials** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Availability of various learning materials | 88% | 92% | 100% | 75% | 100% | 88% | 100% | 100% | 93% |
| Accessibility of the educational materials | 75% | 100% | 100% | 75% | 100% | 100% | 100% | 100% | 94% |
| Storage spaces for educational materials | 100% | 100% | 100% | 100% | 75% | 100% | 100% | 100% | 97% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Security of educational materials areas | 83% | 92% | 100% | 88% | 88% | 75% | 100% | 100% | 91% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Presentation Tools** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Divers means for presenting and exchanging knowledge and ideas | 92% | 90% | 100% | 68% | 100% | 100% | 100% | 86% | 92% |
| Accessibility and ready use of the devices | 83% | 78% | 100% | 83% | 83% | 83% | 100% | 100% | 89% |
| Availability of technical and logistical supports | 90% | 100% | 100% | 60% | 80% | 100% | 100% | 100% | 91% |
| Environmental quality of the space for display | 88% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 98% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Collective Teaching (lecture) Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Centric teacher's position within the learning space | 90% | 80% | 100% | 60% | 100% | 93% | 100% | 50% | 84% |
| Effective visual communication between the teacher and the students | 88% | 75% | 100% | 100% | 100% | 88% | 88% | 50% | 86% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Collaborative Work Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Easiness to arrange and rearrange furniture and working surfaces to form different group sizes as needed | 75% | 83% | 100% | 75% | 80% | 100% | 100% | 88% | 88% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Affording adequate storage spaces to keep groups' works | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 50% | 94% |
| Provide diverse physical environments for collaborative work, to effectively facilitate different activities and stimulating students | 80% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 98% |
| Flexibility to move from one activity to another | 100% | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 94% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Individual Work Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Adequacy of desk surface for conducting diverse activities simultaneously | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Readiness of technical support (ex: electrical extension, outlets and task-light) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 50% | 94% |
| Personalization of the individual workstation | 71% | 100% | 100% | 100% | 71% | 100% | 100% | 100% | 93% |
| Adequacy of sound performance of building materials, finishes and furniture (sound absorption materials) | 100% | 67% | 100% | 100% | 100% | | 100% | | 94% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Creative and Conceiving Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Exterior building form | 100% | 100% | 100% | 88% | 50% | 100% | 100% | 100% | 92% |
| Interior characteristics of the building | 100% | 100% | 100% | 75% | 80% | 100% | 100% | 100% | 94% |
| Designing the school as an "open textbook" (Safely exposing some of the building operational systems) | 75% | 100% | 100% | | 75% | 100% | 100% | 100% | 93% |
| Introducing new learning environments that are pleasant to | 83% | 100% | 100% | 83% | 100% | 100% | 100% | 100% | 96% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| students | | | | | | | | | |
| Providing areas (corners) stimulating creative thinking within the main learning spaces or around the supporting spaces | 100% | 100% | 100% | 83% | 75% | 100% | 100% | 100% | 95% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Hands-on: Scientific Experiments** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Collective teaching and demonstration | 100% | 100% | 100% | 83% | 83% | 100% | 100% | 100% | 96% |
| Laboratory activities of individuals and small groups | 88% | 100% | 100% | 75% | 88% | 100% | 100% | 100% | 94% |
| Non-laboratory activities of individuals and groups (collecting information, planning for experiment, writing reports, discussing works) | 100% | 100% | 100% | 75% | 100% | 100% | 100% | 100% | 97% |
| Safety considerations | 67% | 100% | 100% | 67% | 100% | 100% | 100% | 100% | 92% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Hands-on: General workshops** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Providing workshops for different purposes including crafts, arts and sciences | 94% | 100% | 100% | 80% | 80% | 100% | 100% | 100% | 94% |
| Providing workshops for heavy projects (ex: building and painting) | 95% | 100% | 100% | 93% | 79% | 100% | 100% | 100% | 96% |
| Availability of sufficient spaces to display students works | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Spaces to store completed student-works, and work under construction | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Discussion and Ideas Exchange** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Spacious environment with minimum obstacles | 100% | 67% | 100% | 100% | 100% | 100% | 100% | 100% | 96% |
| Arrangement of seats in away allow direct communication of students/teachers, students/students | 93% | 93% | 100% | 100% | 100% | 100% | 100% | 100% | 98% |
| Diversity of presentation tools | 75% | 93% | 100% | 100% | 100% | 100% | 100% | 100% | 96% |
| Availability of sufficient and divers places to present students works | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Acoustical and visual treatment of the physical environment | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Collecting data and information** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Availability of various learning resources: written, audio, visual, an electronic (review educational materials | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Allocate specialized spaces for library and learning resources (Centric position in the school building) | 100% | 100% | 100% | 83% | 100% | 100% | 100% | 100% | 98% |
| Ability to accommodate verity of sitting and activities | 94% | 94% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Computer and technology area | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Availability of wide-collection of presentation and display devices | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Affording some of the learning resources within the main learning space (classroom) | 95% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Social Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Providing social corners within main learning spaces (classroom) | 67% | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 90% |
| Providing social corners around the main spaces and supporting spaces (ex: classrooms, labs) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Utilizing spaces traditionally not programmed as learning spaces | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Circulation: corridors and intersections | 100% | 100% | 100% | 88% | 100% | 100% | 100% | 100% | 98% |
| Interior courtyards | 93% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |
| Exterior courtyards | 93% | 100% | 100% | 100% | 93% | 100% | 100% | 100% | 98% |
| Cafeteria | 92% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Technology-Based Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Improving the efficiency of building operation and functionality | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Utilizing modern technology for building as 3D textbook | 92% | 100% | 100% | 88% | 50% | 100% | 100% | 100% | 91% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improving the functional performance of the building through utilizing all/most of its spaces as places for learning | 92% | 92% | 100% | 50% | 100% | 100% | 100% | 100% | 92% |
| Improving classroom interaction, and the interaction with the scientific subject through using technology within the man learning spaces | 88% | 96% | 100% | 100% | 50% | 100% | 100% | 100% | 92% |
| Availability of advanced technology labs for specialize works | 89% | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 92% |
| Ensuring stable power source and other electrical requirements | 100% | 67% | 100% | 100% | 100% | 100% | 100% | 100% | 96% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Relaxing and Refreshing Time** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Within over all school facility | 100% | 89% | 100% | 100% | 75% | 100% | 100% | 100% | 95% |
| Within main and supporting learning spaces | 83% | 100% | 100% | 92% | 75% | 100% | 100% | 100% | 94% |
| | | | | | | | | | |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Community Related Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| requiring students to conduct some of the learning activities in the community | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| School facilities serving the community | 100% | 100% | 100% | 90% | 100% | 100% | 100% | 100% | 99% |
| Exterior features | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Interior features | 94% | 100% | 100% | 92% | 100% | 100% | 100% | 100% | 98% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Divers Activities Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Design spaces to accommodate general requirements | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Possibility to accommodate future changes | 93% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |
| Ability to accommodate divers activities | 100% | 100% | 100% | 100% | 90% | 100% | 100% | 100% | 99% |
| Ability to modify space capacity and configuration and the way it is arranged | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Utilization of indoor and outdoor courts and fields | 100% | 100% | 100% | 100% | 75% | 100% | 100% | 100% | 97% |
| Ability of building systems to accommodate changes | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Availability of general purposes storing spaces | 89% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Orderly-Configured Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Clear arrangement of facility spaces in terms of users types | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Dividing school facility into smaller learning academies | 100% | 96% | 100% | 100% | 94% | 100% | 100% | 100% | 99% |
| Extend activities into circulation for integrative spaces | 93% | 100% | 100% | 100% | 70% | 100% | 100% | 100% | 95% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Integration between indoor and outdoor environments | 100% | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 94% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **Dynamic Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Dividing the main learning space according to intended activities | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Locating teacher(s) workplace close to team workplaces | 100% | 67% | 100% | 100% | 100% | 100% | 100% | 100% | 96% |
| Reducing moving paths within each function, and identifying them clearly between different functions | 100% | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 94% |
| Arranging teamwork stations in cluster form, related from within and interconnect with other clusters | 100% | 100% | 100% | 100% | 50% | 100% | 100% | 50% | 88% |
| Locating activities involving the use of large equipments to the side of the space and close to the walls | 100% | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 94% |
| Use of movable furniture | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Functional integration between adjacent and close spaces | 100% | 67% | 100% | 100% | 50% | 100% | 100% | 100% | 90% |
| Spaciousness of school entrances (specially the main entrance) | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 100% | 94% |
| Spaciousness of entrance foyer | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 50% | 88% |
| Spaciousness of circulation paths | 100% | 100% | 100% | 50% | 100% | 100% | 100% | 50% | 88% |
| Shortening of long corridor by introducing main circulation nodes | 100% | 67% | 100% | 100% | 50% | 100% | 100% | 100% | 90% |
| Easiness to understand and remember circulation paths | 83% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 98% |
| Vertical circulation elements; Staircases | 92% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 99% |

| **Activity Setting** | **Al-Khaleej** | | **Al-Kesaea** | | **Al-Jeser** | | **P. Mohammad** | | **Level of Agreement AVERAGE** |
|---|---|---|---|---|---|---|---|---|---|
| **High-Operational Performance Activity Setting** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | **TEC** | **STU** | |
| Ability to control environmental parameters and adapt them to users' needs | 100% | 100% | 100% | 100% | 80% | 100% | 100% | 100% | 98% |
| Lighting performance | 100% | 100% | 100% | 80% | 100% | 100% | 100% | 100% | 98% |
| Exterior sources of noise | 100% | 100% | 100% | 100% | 88% | 100% | 100% | 100% | 98% |
| Noise sources from within the school and outside the learning spaces | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Noise sources from within the learning spaces | 100% | 100% | 100% | 88% | 75% | 100% | 100% | 100% | 95% |
| Energy conservation and thermal comfort | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Thermal performance | 100% | 100% | 100% | 75% | 100% | 100% | 100% | 100% | 97% |
| Indoor air quality | 100% | 83% | 100% | 100% | 100% | 100% | 100% | 100% | 98% |

# VITAE


| | |
|---|---|
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